Vol. 48 No. 1 July 1954

Quarterly

of the

National Fire Protection Association

INTERNATIONAL

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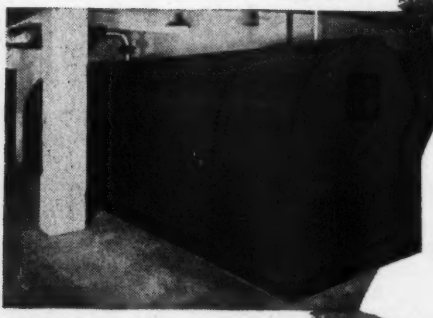

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The Standard Technical Journal of Fire Protection for More Than Forty Years

The NFPA is a non-profit technical and educational organization devoted to the reduction of loss of life and property by fire with a total membership of 15,000. The *Quarterly* is one of the publications regularly provided to members. Other membership publications include a monthly *Fire News, Advance Reports* and *Proceedings* of the Annual Meetings, a *Year Book,* and many leaflets, pamphlets and posters issued throughout the year on fire prevention and control.

NFPA annual dues are $12.50 for Associate Membership of which $5.00 is for subscription to this Journal. National and regional societies or associations may apply for an organization membership for which annual dues are $100; such a membership entitles four individuals to receive the periodical membership publications.

Technical committees of the Association develop means to safeguard life and property through the publication of standards covering all phases of fire prevention and protection. Your membership in the Association affords an opportunity to keep abreast of these developments and, by being a member, you help support this humanitarian activity. Popular educational literature on fire safety is constantly being produced by the NFPA for distribution through its members to the general public.

National Fire Protection Association
International

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Wide World Photo

The value of a Harbor Emergency Force was illustrated during this fire at the Tide Water Associated Marine Oil Terminal in Los Angeles Harbor (San Pedro, Calif.), on June 26. Admiral Frank D. Higbee, Port Warden and Chairman of the NFPA Committee on Harbor Emergency Organization, telegraphed the Association on the day of the fire that all vessels threatened were evacuated, that a buoyant oil boom was strung to confine any oil which might (but did not) escape into harbor waters, and that no docks or port facilities other than the tanks destroyed sustained damage.

Tank Car Explosion
Institute, West Virginia, June 4, 1954

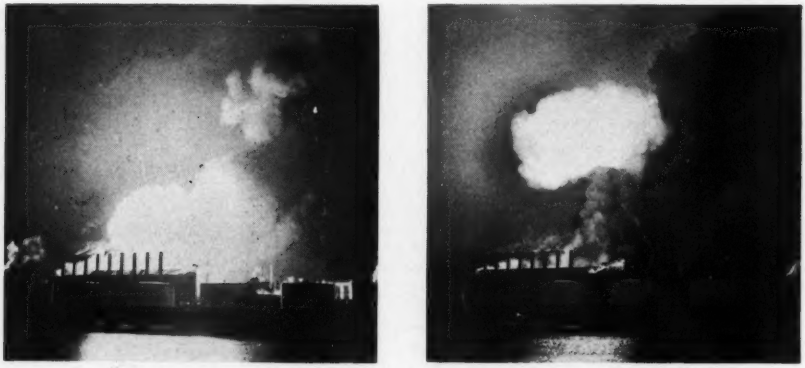
By M. E. Woodworth, NFPA Flammable Liquids Engineer

On June 4, 1954, at 7:31 P.M., an explosion followed by fire occurred at the Institute, West Virginia Plant of Carbide and Carbon Chemicals Company, a Division of Union Carbide and Carbon Corporation. The cause was an uncontrolled chemical reaction of an organic chemical which had become inadvertently contaminated during transfer from a storage tank to the tank car. The explosion of the tank car from overpressure resulted in widespread damage. Fifteen per cent of the 200 operating personnel on duty on the evening shift were either hospitalized or removed from the plant area for first aid. The necessity of complete plant shutdown and care of injured by the limited personnel who did not suffer shock effects, and a number of subsequent explosions posed a critical fire fighting problem. As an example, of the eight operators in the steam plant and switchroom, seven were incapacitated due to injuries. This condition alone was the primary cause for loss of the steam plant, which, in turn, caused loss of the fire pumps.

The company's emergency procedure and the Kanawha Valley Industrial Emergency Plan were activated. Off-shift operating department supervision and emergency personnel were called in. According to pre-arranged plans, traffic diversion was effectively accomplished and appropriate employee credentials allowed quick

Aerial view of the plant taken after the fire. Fire damage was confined to the area bounded by the dotted line.

to confine any oil which might (but did not) escape into harbor waters, and that no docks or port facilities other than the tanks destroyed sustained damage.



Successive views of fire that followed rupture of an acetaldehyde sphere.

passage through road blocks. Seven municipal fire companies, ambulances, medical and first aid supplies, personnel protective equipment, emergency lighting, heavy equipment, and other needed emergency facilities were secured expeditiously. Emergency communications were set up through state police cooperation, hospitals alerted and press relation functions established through pre-arranged company procedures.

An extremely complex arrangement of emergency water supplies was used and cooperation of company management and municipal fire departments was splendid.

Sequence of Events

At 7:20 P.M. on Friday, June 4, the fire alarm was sounded at the Institute Plant of Carbide and Carbon Chemicals Company, located about 10 miles west of Charleston, West Virginia. The alarm had been sounded because of vapors escaping from a relief valve of a tank car containing acrolein.* The plant fire brigade reported to the tank car location with their 500 gallons per minute pumper and laid two hose lines from yard hydrants. These hose streams were applied in an attempt to absorb the toxic vapors which are soluble in water. When intermittent operation of the safety valves changed to continuous operation it was obvious that pressure was building up in the car and the area foreman in charge ordered the brigade to drop its lines and leave the area. These men had gone only a short distance when the tank car ** exploded with extreme violence at 7:31 P.M.

Minor building damage and broken windows occurred at distances of over two miles from the plant. Ten minutes later an ethylene oxide tank (6,000 gallons) exploded and a number of other small tanks in the same area ruptured. There were 34 process tanks of 6,000 gallons capacity each containing intermediate

*Acrolein (acrylic aldehyde; propenal) is a highly toxic colorless flammable liquid having a characteristic pungent and exceedingly irritating odor. Boiling point, 125°F.; vapor density (air=1), 1.94; specific gravity at 68°F. (water=1), 0.8425; flash point (closed cup), below 0°F.; heat of combustion, 6,191 cal. per g.; soluble in water. (See NFPA Handbook of Fire Protection, 11th Edition and Underwriters' Laboratories, Inc. Card Data Service M60 for additional information.)

**ICC 105A-500-W used in ICC 105A-300-W service. ICC-105A tank cars are insulated and equipped with safety valves. These valves are not designed to relieve pressures of the magnitude developed by this uncontrolled chemical reaction.

products in this tank area. Eighteen of these tanks suffered no damage, 12 were damaged beyond repair and 4 suffered minor damage. At 9:05 P.M. a 30-foot diameter, 30-pound per square inch working pressure sphere containing acetaldehyde* ruptured causing a column of fire to roll skyward an estimated 300 to 400 feet (see photos on previous page).

Since the Company is still engaged in the reconstruction work, its officials feel it is still premature to make any estimates of total loss. NFPA representatives have estimated that the loss will run in the neighborhood of $1,750,000 damage at the Institute Plant plus several thousand dollars worth of damage to property of others.

There were no fatalities. Of the approximately 200 employees working at the time (total employment: 1,750) only 14 sustained any lost time injuries. Twenty-nine plant employees were injured and about an equal number of persons outside the plant were treated for shock or minor injuries due to broken glass or falling debris.

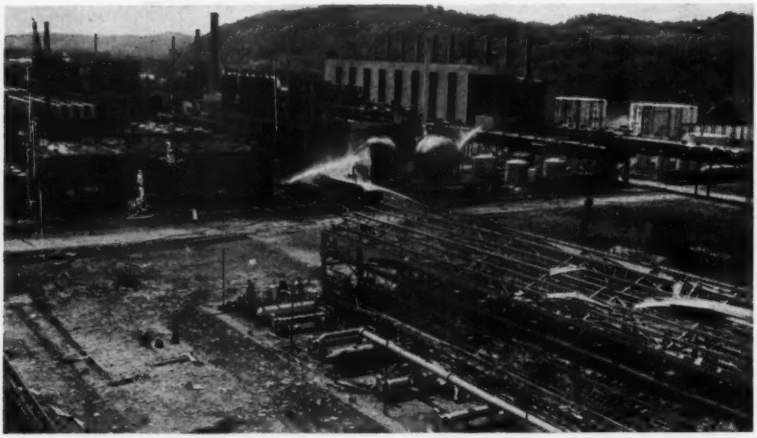
The Plant Site

Charleston and other adjacent cities are built along a narrow strip of land on both sides of the Kanawha River with hills rising sharply on each side. In the west portion of this industrialized valley lies the Institute Plant of Carbide and Carbon Chemicals Company whose main plant is located about 10 miles east in South Charleston, West Virginia. The Institute Plant was built in 1942 by the government as the first alcohol process butadiene plant in the nation for manufacture of synthetic rubber. It was then operated and is now owned by Carbide. Another first for this plant, of interest to the fire protection profession, is that the first large scale installation of water spray systems for fire exposure protection of flammable liquids processing and storage facilities was made here and served as a forerunner of NFPA Standards for Water Spray Systems for Fire Protection (NFPA No. 15).

Cause of Explosion

The tank car involved in this incident exploded from overpressure resulting from an accidental and uncontrolled chemical reaction with subsequent ignition of released contents. It had just been filled with acrolein which, except when contaminated or mixed with certain other materials, is a stable material in its inhibited state. The cause of the accident was the contamination of the product in the transfer line and not the fault of the acrolein or of the tank car. The source of contamination has been determined by the company and appropriate measures have been taken to prevent recurrence. It is emphasized that this occurrence was an in-plant condition and the operating procedures, if followed, would have prevented the accident. There are many combinations of chemicals which will react on mixing in a closed container and cause a build-up of temperature and pressure. Fortunately, these mixtures and possibilities of accidental mixing occur only within manufacturing and consuming plants. With customary laboratory sampling procedures and adherence to other regulations, the possibility of a tank car leaving a plant prior to a reaction caused by contamination is considered extremely remote. The existing Company and govern-

*Acetaldehyde is a water soluble flammable liquid. Flash point (closed cup), minus 36°F.; ignition temperature, 365°F.; explosive limits, 4.1 and 55 per cent by volume; specific gravity (water=1), 0.783; vapor density (air=1), 1.52; boiling point, 70°F.



General view of most serious damage. Tank car was spotted in front of sphere, center of picture. The end of the steam plant, at left of spheres, was blown out and the roof and siding of the compressor building in foreground were destroyed. Good plant layout and noncombustible construction were significant factors in confinement of fire to area of spheres and unit behind it.

mental standards for safe shipment of acrolein are considered adequate but are being thoroughly reviewed.

Explosion Damage

As could be expected, an explosion of this type caused severe damage to adjacent buildings and tankage. Damage to property outside the plant premises consisted mostly of broken windows and doors with some roofing and structural damage. All serious effects were within 1,000 ft. of the tank car and these, for the most part, involved the architectural features of the plant. Open structures and manufacturing or storage equipment in adjacent areas suffered relatively minor damage as compared with closed structures. The property loss was low in consideration of the magnitude of the occurrence. The fact that 90 per cent of plant operating facilities are outdoors is significant. The vagaries of explosions were evident in the effects created by the blast and by the vacuum created following the blast wave. For example, a load-bearing wall in a stores building 1,000 ft. away was sucked out resulting in a partial collapse of the roof and a broken sprinkler riser.

Several large atmospheric flammable liquid storage tanks an equal distance away suffered damaged roofs (roof seams were torn open) and vent units were broken off at the connection to the tank. Two atmospheric tanks were moved 12 inches toward the source of the explosion. On the other hand, smaller storage tanks within 100 feet of the tank car loading spot were undamaged. A 25-ton overhead crane was thrown off its tracks in a nearby compressor building. Large glass block panels in the steam plant, the end of which was over 300 feet away, were blown through the steam plant structure whereas, in an adjacent building, the windows and doors fell outward due to a vacuum effect. Fortunately, the ensuing fire did not involve or spread to these damaged structures and equipment.

Water Supply

A well-gridded fire main system covered the plant and was supplied by two 1,500 gallon per minute electric driven pumps and two 1,500 gallon per minute steam turbine driven pumps. In addition, there were sixteen 11,000 gallon per minute pumps used for supplying process cooling water through two 54-inch mains. This cooling water automatically served the fire mains by means of check valves in the event pressure in the fire mains dropped below 50 pounds. A 100,000-gallon elevated water tank served as a primary water supply and normally maintained about 65 pounds per square inch on the fire hydrant system.

As stated before, the steam plant and switchroom suffered severe damage. Steam headers were ruptured, electrical controls were destroyed and the source of treated water for boilers was lost through lack of operating personnel to give attention to necessary valving operations. The primary reason for not maintaining at least one or two boilers in operation which would have provided a 4,500 gallon per minute water supply for fire protection from two steam driven fire pumps (overload capacity) was the injury and shock effects to all personnel in the boiler and switch house. Company officials emphasized that the important lesson is that large boiler installations, electrical distribution systems, and fire pumps must be operated by people—loss of people obviously means loss of the facilities that they attend unless automatic features sustain such operations. The near-by switch house which was damaged as much as the boiler house was served by three independent sources of power but damage to main busses and critical control facilities rendered the two electrically driven fire pumps out of service until emergency repairs could be completed. Incidentally, even though one of the electric pump motors was burned out during starting, a replacement motor was secured from the vendor, installed, and the pump restored to service within 72 hours. The other electric driven pump was placed in service at about 1:15 A.M., approximately 6 hours after the explosion. The two steam turbine driven fire pumps were restored to service in about 36 hours.

With the loss of the 500-gallon fire department pumper (destroyed by the original explosion) and the four stationary fire pumps, the only source of water left for fire fighting was the 100,000-gallon gravity tank. Recording pressure charts on the plant fire hydrant system indicated that the gravity tank supply lasted about 4 minutes. There were a few serious breaks in the water system. One of these was the ruptured 8-inch sprinkler riser in the collapsed stores building mentioned before (see photo next page). Several other standard sprinkler systems were broken, the significant reason for such breakage being the damage effects on architectural features of the plant.

For example, standard sprinklers supported from roof beams failed because of roof damage whereas similarly exposed feed mains to outside water spray systems did not fail. In addition to the breaks, another source of water usage during the 4-minute period the gravity tank lasted was a large number of water spray system actuations. Whether these systems were manually operated, automatically operated because of fire exposure, or operated because of shock effects or damage to the heat detection system is not yet known. However, it is believed that the water spray and sprinkler coverage may have extinguished, controlled, or prevented a

Load-bearing wall collapse in stores building 1000 ft. away. This type of construction, dictated by wartime restrictions, has obvious protection limitations. Note accessible sprinkler valve in left foreground; this valve had to be closed to conserve water escaping from broken sprinkler piping.

number of fires in the perimeter area. It is impossible to evaluate accurately the worth of the overhead gravity tank and water spray and sprinkler equipment in this instance. The complete shutdown of all plant chemical units was accomplished without incident and with a reduced force of operating personnel.

Emergency Plans

The most outstanding lesson to be learned from this incident is the remarkable success of the plant's emergency plan and the industrial mutual aid plan in the Kanawha Valley. All industry, fire, police, medical, transportation, utilities, hospitals, press, and radio in the Charleston area have been developing for several years a plan which, in the event of an emergency, could be immediately activated. Seven minutes after the explosion the state police, Company B headquarters at South Charleston, notified Carbide and Carbon officials that the roadblocks were established, hospitals alerted and ambulances dispatched. Through the plant emergency program, off-duty key personnel reported on the scene without delay. Having emergency passes, these designated personnel had no trouble passing through roadblocks. The same was true for all emergency vehicles. This pre-planning unquestionably proved its worth and clearly demonstrated again that in those areas in the nation where this detailed planning is done, significantly less trouble is experienced. A minimum amount of trouble with highways congested by sightseers is experienced.

Compare this example of pre-planning with the chaos which has existed in those areas without a thorough and complete plan of roadblocks, emergency communications and liaison between protective agencies. A good example of mutual aid was the telephone system. The plant telephone exchange was knocked out by the explosion but within less than half an hour the telephone company was on

the scene with portable generators and had the switchboard back in service. The fire services organized under the county Civil Defense Plan responded when called and these included fire companies from Charleston, South Charleston, Winfield, Nitro, St. Albans, Dunbar and the county airport. Six of these pumpers were 750 gallon per minute capacity and one 500 gallon per minute. The nearby B. F. Goodrich Company plant also reported with their 750 gallon per minute pumper. Except for Charleston and the B. F. Goodrich unit these departments are volunteer with some paid personnel.

Summary of Emergency Work

In summary, the significant functions performed under the plant emergency and mutual aid plans were as follows: (1) activation of the Kanawha Valley Emergency Traffic Plan to divert traffic away from the area and insure movement of emergency vehicles to the scene, to sources of emergency supplies, and to hospitals; (2) call-in of all off-shift operating department supervisors for obvious duties in their respective units; (3) call-in of Carbide emergency fire fighting, utility and maintenance forces who are organized to supplement the plant fire brigade organization under direction of the shift superintendent and plant management.

Other examples of splendid cooperative effort were apparent. Hospitals were alerted and injured removed from the plant area within a half hour. The seven fire departments were on the scene within 20 minutes of the time they were called. Personnel protective equipment, emergency lighting facilities, some heavy equipment, extra fire hose, flashlights, food, and other needed emergency facilities were conveyed to the scene with dispatch. Over 100 trained personnel were moved in for emergency duty from the near-by sister South Charleston plant of Carbide and Carbon Chemicals Company to assist the Institute plant emergency organization. Press, radio and TV coverage was channeled through established procedures and an excellent spirit of cooperation prevailed.

In commenting upon the effectiveness of the mutual aid program, the editor of the Charleston Gazette had the following to say in a follow-up front page editorial:

> "High commendation goes not only to Carbide officials, who kept the public advised by press and radio, but also the recently organized Kanawha Valley Emergency Planning Committee. This group is composed of industrialists, local and state police, national guard and others.
>
> "But for them the confusion and panic which has reigned in previous accidents would have reached an all-time high. To their complete credit it must be said that roadblocks were promptly erected and only those persons properly accredited were permitted within the disaster area."

Fire Fighting Operations

The fire fighting ingenuity and cooperation is another remarkable feature of this accident. Imagine if you can a large chemical plant where there have already been two severe explosions and several minor ones, no lights in the plant, no water for fire fighting and no knowing what might happen next.

Many of the plant personnel, including fire squad members, were evacuating the area because of the toxic gas release from the tank car safety valve before the tank car exploded. Many were injured, knocked down, shaken or dazed. Most of the remainder sought to aid the injured. Some few remained and safely shut down all production units.

Adjacent chemical unit—all damage from initial explosion. Sprinkler system ruptured. Control valve in foreground was one of several that had to be closed in order to utilize the plant hydrant system in the immediate fire area.

The need for water for fire fighting was obvious and the first step taken was to verify that the fire pumps in the steam plant could not be operated. Then during the course of the next hour and a half three separate water sources were utilized to obtain supplies for water spray and sprinkler systems in the areas immediately bordering the fire and for hose streams. The first two effective hose streams were from a 6-inch city water main. The fittings necessary for this operation were obtained from the plant storeroom and the plant fire station. The installation was made by an emergency pipe fitter crew. A third line was supplied from another city water connection at another part of the plant from which a 250 gallon per minute portable pump took suction and in turn supplied a fire department pumper which delivered one stream to the fire area. Four additional 2½-inch lines were put in service from other sanitary water connections. The use of city water supplies for fire fighting was implemented through cooperation of the West Virginia Water Service Company which, through radio communication, dispatched a man to accomplish necessary operating changes to raise pressures from 80 to 120 pounds.

Like city water, river water was available but difficult to obtain. An access way was available to the river for fire department pumpers but the location unfortunately was adjacent to the explosion area and was partially blocked by debris, thus being subject to additional explosion hazard. A hole was cut in a fence and a 500 gallon per minute portable trailer pump was lowered over the steep river bank to the water's edge by a winch. This pump took suction at a lift of 5 feet and through two 100-foot 2½-inch lines supplied a fire department pumper which, in turn, through two 300-foot 2½-inch lines,

pumped water into the hydrant system through the test manifold at one of the river pump houses. This and other like operations supplied water to the plant fire mains in order to make use of fixed water spray and sprinkler systems and to furnish hose streams from the plant hydrant system. Other departments located portable pumps at the water's edge and through relay pump operations supplied maximum capacity of the portable pumps into the plant fire mains.

The third independent source of water made available for fire fighting was a million gallons of water that happened to be in a new 2½ million gallon floating roof storage tank that was undergoing a hydrostatic test. One 750 gallon per minute fire department pumper was assigned this location to furnish water to the hydrant system. A 4½-inch suction was connected into the 6-inch outlet on the tank. This crude adapter was tied and wrapped and the connections caulked with rags. This was typical of the improvisations that were made successfully.

While the foregoing efforts to obtain water were in progress, a concerted effort was also being made to shut down the ruptured and unneeded spray and sprinkler systems in order to conserve water and increase the hydrant system pressure to a point where effective hose stream operations could be achieved. These shutdowns were completed at about 10:00 P.M. and by 10:30 P.M. effective hose streams were being applied in the fire area; water spray systems in the area of the ethylene oxide tank explosion proved to be operable and afforded effective coverage of flammable liquid tankage in the immediate area that was not yet involved. With the exposures well protected, hose streams were advanced to the seat of the fire and operating personnel under the protection of small hose lines equipped with spray nozzles shut off fuel feeding the fire. The complexity of fire fighting operations is indicated by the fact that over 20,000 feet of hose was used. A large number of portable extinguishers were applied to control minor fires in the perimeter areas. Without water in the early stages of the fire it was realized that complete dependence had to be placed on portable extinguisher operation for controlling fires that started in other segments of the plant. The county airport "crash type" fire department unit was available for use in the event an outlying fire did get out of control.

Arrangements were made with a tugboat operator to hold a barge in standby at a dock a few miles down the river. It was planned that if additional fire department pumpers were needed, these pumpers would be placed on the barge by heavy cranes and the barge would be taken to an upstream location near the plant. This maneuver proved unnecessary because of the rapid control of the fire after fire fighting operations began.

Fire Fighting Concentrated

At the time fire department pumper operations were first organized, the decision was rightfully made that fire fighting crews would not be sent into the immediate area until adequate hose lines and reliable water supplies were available. An example of the wisdom of this decision was the rupture of the acetaldehyde sphere at about 9:00 P.M., which was approximately an hour before the complicated water supply was ready for action. Carbide officials directing the emergency actually noted the blister forming on the sphere and all personnel were ordered out of the danger area ten minutes before the

Damaged chemical production unit in which initial explosion caused fire and loss of about one-third of tankage on concrete-curbed and water-sprayed area at right. When water supplies became available, these spray systems were found effective even though considerably damaged.

rupture occurred. This was a very spectacular failure and a tremendous volume of vapor was released through a 10-foot-long opening near the top of the sphere. A column of flame mushroomed skyward several hundred feet and radiant heat was noticeable half a mile away (see photos page 6).

By 11:15 P.M. the fire was definitely under control. The fire continued to burn for 14 hours but this was purposely permitted in order to consume escaping vapors. The last source of fire to be extinguished involved acetaldehyde vapors burning at the tear in the ruptured sphere. Care was taken not to cool down this sphere which possibly could have caused an explosion. A water line was connected to a bottom connection on the sphere and the sphere filled gradually. Acetaldehyde is water soluble and this maneuver finally extinguished this last remaining fire by dilution.

Of particular interest to fire fighters is the complete cooperation which existed between plant management and the fire departments. This cooperation served to protect the firemen and to utilize the available water in the most effective way. Special attention was directed toward use of the fixed water spray and sprinkler systems and controls to close off damaged facilities of this type in order to make effective use of the plant hydrant system. The primary effort had to be placed on building up an adequate water supply based on an evaluation of need to cope with the existent fire. Many of the hose lines were laid dry into the fire area. Then when sufficient water became available for the operation of these hose lines and needed water spray systems, they were quickly put to use and the fire was controlled within a very short time.

Conclusions

1. It is important that all individuals concerned with the handling of hazardous materials adhere strictly to operating procedures.

2. The value of an established and practical mutual aid plan including industry, utilities, commercial establishments that serve industry, and governmental protective agencies cannot be too greatly stressed.

3. Excellent spacing and proper layout of plant facilities were significant factors in confinement of the fire which followed the explosion and in minimizing blast effects on the total plant. (Approximately 80 per cent of plant production was restored within two weeks.)

4. Closed structures were seriously damaged whereas open structures were, for the most part, undamaged.

5. Architectural features such as brick parapet walls, large windowed or glass block areas, and brick veneer presented an exposure hazard to personnel and equipment from the standpoint of falling debris. Structural features of roofs, disadvantages of the load-bearing walls used in the plant and safer locations for sprinkler risers are specific subjects for fire protection engineering study. Adequacy of tank venting facilities and effectiveness of concrete curbed area segregation, drainage, and fireproofing of structural supports were major factors in the reduction of fire spread under prevailing conditions.

6. Auxiliary pumping facilities for fire protection were needed in either the form of diesel or gasoline driven fire pumps or a diesel or gasoline operated generator arranged to serve electric driven pumps in the event of power outage.

7. The importance and effectiveness of a plant emergency plan including calling-in of key off-duty personnel was proven. The emergency training of Company employees was particularly evident throughout the entire incident. The significance of having experienced leadership was obvious. Examples include emergency shutdown procedures for process units despite damage and darkness, handling of the injured, complex fire fighting tactics, and public relations problems.

8. Deficiencies in field communications, the need for an over-all command post and other faults evident to Carbide's investigation team will be discussed at planned critiques within the plant organization and within the Kanawha Valley Mutual Aid organization.

9. The plant's industrial relations department is to be commended for its excellent press and radio relations. This assured good reporting of the incident and prevented scare-type rumors.

10. Acrolein, although a recognized toxic and fire hazard, should not be considered as any undue hazard in transportation. Such a tank car explosion as this obviously should prompt attention to a review of safe practices concerned with the handling of chemically reactive materials. Most attention should obviously be paid to preventing fires and explosions; however, as long as the potential of human error exists, it is necessary to plan and be organized and equipped to cope with accidents that may occur.

Meetings of Board of Directors

Washington, May 17, 1954

Present

Richard E. Vernor, Chairman
Allen L. Cobb, President
T. Seddon Duke, Vice-President
John A. Neale, Vice-President

Warren J. Baker
A. L. Brown
C. H. Bunn, Jr.
Loren S. Bush
E. Gaston
A. Leslie Ham
Geo. J. Richardson
Henry G. Thomas
Joe R. Yockers

Percy Bugbee, General Manager; Robert S. Moulton, Technical Secretary.

Business Transacted

1. The report of Chairman Vernor of the Board of Directors to the opening session of the annual meeting was reviewed and approved.

2. Chairman Vernor advised the Board that four NFPA members had completed 50 years of continuous membership as of this year, these members being John Derby of New York, A. A. Moser of Westfield, N. J., J. V. Nutter of Winnipeg, and C. L. Scofield of Montreal.

3. The report of Treasurer Hovey T. Freeman and the auditor's report were reviewed and approved.

4. The General Manager made informal reports to the Board on the following items: the Advertising Council campaign, the Seattle Regional Conference scheduled for September 20-22, 1954, the reorganization of the Boston Fire Department, the fire prevention article in the April issue of Woman's Home Companion, and proposals to move the Executive Offices to a suburban site.

5. It was voted to hold the next meeting of the Board at the Hotel Statler in Boston on Monday, June 28.

Boston, Mass., June 28, 1954

Present

Richard E. Vernor, Chairman
T. Seddon Duke, President
John A. Neale, Vice-President
Henry G. Thomas, Vice-President
Allen L. Cobb, Past President
Hovey T. Freeman, Secretary-Treasurer

Warren J. Baker
A. L. Brown
E. Kenneth Clark
P. E. Dannenman
Franklin R. Fetherston
A. Leslie Ham
Leonard Peterson
J. Sharp Queener
Elmer F. Reske
Geo. J. Richardson
Frank D. Ross
Roger H. Wingate

Percy Bugbee, General Manager; Robert S. Moulton, Technical Secretary; Horatio Bond, Chief Engineer; Charles S. Morgan, Assistant General Manager; George H. Tryon, Assistant Technical Secretary; H. E. C. Rainey, Chairman, Membership Committee; Cuyler Stevens, representative, Committee on Public Relations.

Business Transacted

1. Officers of the Corporation were elected in accordance with the vote of the annual meeting as follows: President, T. Seddon Duke; Vice-President, John A. Neale; Vice-President, Henry G. Thomas; Secretary-Treasurer, Hovey T. Freeman; Chairman, Board of Directors, Richard E. Vernor.

2. The Advisory Committee for 1954-55 was appointed to consist of the officers.

3. Messrs. A. L. Brown and Franklin R. Fetherston were selected to complete the Nominating Committee for 1955.

4. General Manager Bugbee reviewed the successful accomplishments of the 1954 annual meeting in Washington and reviewed plans for the 1955 annual meeting to be held at the Hotel Netherlands Plaza, Cincinnati, May 16-20. It was voted to approve the plans as presented and the General Manager was instructed to proceed accordingly. It was further voted to approve the following tentative

dates for future annual meetings: Boston —June 4-8, 1956; Los Angeles—May 20-24, 1957; Chicago—May 19-23, 1958; New York, May 18-22, 1959.

5. The Program Committee for the 1955 annual meeting was appointed to consist of the President, the Chairman of the Board of Directors, and the General Manager, with authority to the Chairman of the Board to make additional appointments to this committee at his discretion.

6. Treasurer Hovey T. Freeman reported on the finances of the Association indicating a favorable result from operations for the past fiscal year. This report was accepted (complete financial statement as circulated with the Board agenda to be published in the NFPA Proceedings 1954).

Reports on Special Projects

7. (a) General Manager Bugbee reported on the Electrical Field Service indicating the increasing field of usefulness of this special NFPA service and the prospects for its more effective financing in the future.

(b) Technical Secretary Moulton reported on the Flammable Liquids Field Service indicating the general satisfaction of the membership with NFPA work in this field and the fact that the budget for this project is in balance. This report was further discussed by Mr. J. Sharp Queener who is Chairman of the Flammable Liquids Sectional Committee on Classification and Labeling and who reported on some of the developments in this special project* and indicated the probable future need of special research in this field which will have to be financed by special contributions for the purpose.

(c) Mr. John A. Neale, reporting as President of the Society of Fire Protection Engineers, discussed the current activities of the Society with special reference to the value of the local chapters. He reported that there was a deficit of $488.71 in the operations of the Society for the fiscal year ending April 30, 1954 and on his motion it was voted that this deficit be absorbed by the NFPA. Mr. Neale further expressed the hope that the Society by some change in its set-up might next year operate in the black.

(d) General Manager Bugbee reported on the Advertising Council project indicating the wide ramifications of this educational activity through contributed advertising time and space. This report included a report on the financial status of this project (see complete financial report for details), indicating a charge against the general expenses of the NFPA of $10,500 in the fiscal year ended April 30 and a deferred charge of $10,000 carried to the current fiscal year in the expectation of receipt of income from royalties on various articles using the name *"Sparky."* Mr. Bugbee also reported on the plans for a children's educational campaign through enrollment in *"Sparky's Fire Department."*

(e) Franklin R. Fetherston, Chairman of the Gases Field Service Committee, and Technical Secretary Moulton reported on the currently successful operations of the gases field service project indicating the satisfactory development of work in this field and that the project, while not yet adequately financed, has operated in the black during the fiscal year just closed (see complete financial statement for further details).

(f) General Manager Bugbee reported on the special project for editing the National Electrical Code whereby funds contributed for this specific project are being expended for a complete editorial revision of the National Electrical Code (see complete financial statement for details).

(g) General Manager Bugbee reported that further funds had not to date been forthcoming in support of the proposed farm fire protection project and that while the Chairman of the NFPA Committee on Farm Fire Protection had indicated a hope and expectation that adequate funds might be secured to implement this project eventually, it was not currently proper to continue to hold unex-

*See Page 57 of this Quarterly

pended funds previously contributed. It was accordingly voted to instruct Mr. Bugbee to return to the contributors the total of $269.80 previously contributed for this project.

8. The Budget for 1954-1955 was amended and adopted in accordance with the recommendation of the Finance Committee.

Seattle Regional Meeting

9. Plans for the NFPA regional meeting in Seattle, Wash., September 20-22, 1954 were presented by Technical Secretary Moulton and Chief Engineer Bond with general discussion by Board members indicating general concurrence as to the value of regional meetings and the desirability of developing the plans for the Seattle meeting along the lines indicated. Several Board members reported their intention to be present.

10. General Manager Bugbee reported in detail on the Advertising Council campaign supplementing the financial report on this campaign previously presented (Minute 7(d)). This report was approved and Mr. Bugbee was requested to continue this activity along present lines.

11. Mr. Cuyler Stevens appeared before the Board as a representative of the Committee on Public Relations presenting various recommendations of the committee for improvement in the NFPA handling of membership solicitation, contacts with industry, and other matters. This report was discussed in some detail by Messrs. Bugbee, Cobb, Dannenman, Ham, Queener and Reske, after which Mr. Bugbee was requested to communicate to the Committee on Public Relations the substance of the discussion.

Technical Committee Activities

12. (a) Mr. Moulton reported that the Committee on Foam had secured substantial agreement on additional amendments to the Standards on Foam Extinguishing Systems referred back to the committee by action of the annual meeting, with authority to report to the Board, and it was voted to authorize the Executive Office to send the revised text to the Board for action by letter ballot after editorial clarification of the text.

(b) The situation with respect to proposed standards for sprinkler installation on shipboard, which was the subject of a report by the Committee on Marine Fire Protection to the annual meeting, was presented by Assistant General Manager Morgan. After a general discussion of the questions of policy involved in this matter, it was voted to authorize Chairman Vernor to appoint a special committee of the Board to investigate this matter and report their recommendations to the Board at its next meeting. Chairman Vernor thereupon announced the appointment of the following special committee: Mr. A. Leslie Ham, Chairman, Mr. A. L. Cobb, Mr. Roger H. Wingate.

(c) A question concerning procedure in adopting standards at the annual meeting was discussed with agreement in principle that the annual meeting, while free to take any desired action on adoption, amendment or rejection of standards proposed by technical committees, should not delegate its authority for action on standards except to the Board of Directors. The Committee on Technical Committee Procedure was requested to consider this matter and draft a text of proposed rules on this subject and submit them to the next meeting of the Board.

13. The report of the Committee on Technical Committee Procedure as submitted by Chairman A. L. Brown was adopted with action on various matters as follows:

The name of the committee was changed from "Committee on Technical Committee Procedure" to "Technical Advisory Committee."

It was voted to submit the 1954 NFPA standard on Building Types (No. 220) to the American Standards Association under the proprietary sponsorship method for approval as an American Standard.

The committee was authorized to proceed with plans for removing from the jurisdiction of the Committee on Building Construction standards on building auxiliary features such as spark arresters, smokepipes and stove pipes, incinerators, chimneys and flues, and assigning them to a new committee or group of committees on building equipment.

The committee was authorized to proceed with plans for subdivision of the Committee on Gases into several sectional committees following the general pattern of organization of the Committee on Flammable Liquids.

The committee was authorized to assign the subject of nonsparking and conductive flooring to the jurisdiction of the Committee on Static Electricity, with the understanding that such changes in the personnel of this committee would be made as may be desirable to qualify it for this additional assignment.

The committee was authorized to proceed along the lines of its report with further developments in the project on Industrial Tractors and Lift Trucks, on clarification of the relations between the Committees on Flameproofing and Preservative Treatments and on Wearing Apparel, and assignment or reassignment of various projects in the field of special extinguishing methods involving combinations of extinguishing methods heretofore treated only separately in NFPA standards.

At the request of the committee, Chairman Wingate of the Committee on Wearing Apparel reported in some detail on the current developments in his committee and the situation with respect to national legislation on this subject.

14. The committee appointments submitted to the Board in the list with the agenda and also a supplementary list presented at the meeting were confirmed. It was voted to reappoint for the year 1954-55 all other technical committee members presently serving except those replaced, unable to serve or removed from the lists. The Technical Advisory Committee was authorized to proceed with additional pending committee appointments for inclusion in the lists published in the 1954 Year Book, subject to confirmation by the Board at its next meeting.

15. The Technical Advisory Committee for 1954-55 was appointed as follows: A. L. Brown, Chairman, Hylton R. Brown, T. Seddon Duke, John A. Neale, Henry G. Thomas.

Electrical Code Handbook

16. Mr. Moulton reported on developments in connection with the publication by the McGraw-Hill Book Company of a new edition of the National Electrical Code Handbook ("Abbott Handbook") for which, in accordance with previous authorization, the NFPA has provided the editorial services of NFPA Electrical Field Engineer Charles L. Smith. This report reflected delays in the publication schedule which would tend to reduce the total expected NFPA income from royalties from the sale of the book, but that the Association might still expect over a period of years a substantial revenue from this source.

17. It was voted to hold the next meeting of the Board at the Union League Club, New York, on Thursday, January 27, 1955.

New Business

18. A communication was presented from Mr. Orville Emory of the U. S. Navy Department making certain suggestions for NFPA service in connection with the activities of the Federal Fire Council. Mr. Bugbee was requested to communicate with Mr. Emory expressing the willingness of the Association to assist in government fire protection matters on official request subject to the necessary limitations inherent in our procedures and staff facilities.

19. Chief Thomas and Mr. Bond reported on developments in connection with civil defense indicating a more effective organizational set-up in Washington as a result of recent changes in the Federal Civil Defense Administration.

The Impact of Livonia on Business*

By Kenneth Kramer

Executive Editor, Business Week
McGraw-Hill Publishing Co., Inc.

The biggest business news story of 1953 was the Livonia fire.†

That is saying something when you consider these 1953 business happenings: over-all business hit a postwar peak; a major business decline set in; air conditioning became a big selling sensation; Washington put the brakes on inflation; the cost of living started going down; business spending for new plants and equipment hit a record high; a new boom began in the stock market; 3-D movies turned Hollywood upside down; price, wage, and credit controls were ended; the excess profits tax died; the Supreme Court knocked out fair trade; color TV got the green light; and, the first mass-produced auto plastic body was built.

Again, the biggest business news story of 1953 was the Livonia fire.

That is because it was a dramatic story. That is because it was about an event that had a tremendous effect on the particular company—General Motors—hit by this disaster. That is because it required a lot of extra effort by a lot of people to minimize the loss as much as possible. But, most importantly, the Livonia fire was the biggest business news story of 1953 because it started everybody in business thinking, or, perhaps, re-thinking his ideas on fire protection.

Mr. Kramer presenting his address at the Final General Session of the 1954 NFPA Annual Meeting.

I am not going to describe the fire. The October 1953 *Quarterly* contains that story. I am just going to discuss the after-effects of Livonia as far as top management in industry is concerned.

One waggish editor said that as a result of the Livonia fire, a "fireproof" building is now considered as "fireproof" as a permanent wave is permanent. That may sound silly but it certainly is true that as far as businessmen are concerned. U. S. plants aren't as "fireproof" as they once thought. Their ideas changed in a hurry, too!

One week after Livonia in August, 1953, we had this report from the Cleveland news bureau of *Business Week*:

* Based on an address by the author at the 58th Annual Meeting of the Association held in Washington, D. C., May 17-21, 1954.

† See October 1953 NFPA Quarterly, pages 105 to 120, or NFPA Reprint Q47-2, 25 cents per copy.

"The X company went to work when one of its executives received a rumor from Detroit that, true or not, was thought-provoking: GM's fire might have been a comparatively small one, the rumor said, if outside help had been called in sooner. As it was, the Livonia plant's own fire fighters thought they could handle matters on their own.

"Acting on this report, the Cleveland company is planning a much closer relationship between its own fire forces and those of the plant community. If there's the slightest chance that a blaze might get out of control, the plant fire chief will call for outside help."

Three Months After

Three months later the Livonia fire was still a major topic of conversation whenever businessmen got together. At that time, many company staffs were busily checking and rechecking fire protection and insurance setups. Top management officials were asking to be informed personally of the results.

GM itself was still laboring mightily to recover its equilibrium. It had reached the point where it had hired Professor John J. Ahern of the Illinois Institute of Technology as a part-time consultant on making its other plants safer.

It also was the time when Ford Motor Company let it be known that it had made a test on fire protection of industrial roofing with some interesting results and conclusions. These were made public shortly thereafter.

One Year Later

Now, it is a year since the biggest single plant fire in history. Perhaps it is time to take another look and see what changes have been wrought.

I reported that one week after Livonia, a Cleveland company decided to do something about its own fire protection setup. What has happened since? Was one meeting held? Was one decision made? Is the company better prepared on the fire protection front than it was?

The X company (it remains unnamed) provides some interesting answers. Again, I read to you a report from Cleveland:

"There has been no occasion actually to test what was discussed, planned, and outlined as the result of the Livonia fire in relation to outside help in case of a fire.

"The company management did take a long and more careful look at its plant fire prevention and fire fighting force. It has had some training of foremen, at the hands of outside fire fighters, on what to do, how to proceed, etc., on different types of fires. The foremen have passed the information along to shop help. More care and attention has been given to fire fighting apparatus and steps taken to identify it more easily in the plants.

"Now I am told that probably part of the answer to the spotless record of the company during the past year has been due to that extra training and planning.

"If there were anything more serious than a stuffed shirt on fire from a live cigarette ash, or a wastebasket smoking, the outside fire departments would be hastily summoned to take over, since, in the case of a serious fire, the plant crew would come under the complete direction of the outside pros."

That report tells you quite graphically, I believe, that the Livonia fire had an impact on top management thinking in that one company right after Livonia, and that the aftereffects have been lasting.

I would not dare to say that that was and is equally true with every company.

The Livonia fire started near this interior partition and spread throughout the 34.5 acre plant which housed the General Motors Hydra-Matic transmission production.

I do know that a number of fresh looks have been taken at fire prevention in the past year. Without getting too specific, I enumerate a list of things that are being or have been thought about, talked about, and/or acted upon in industry. I am bold enough to say that all these things are results of the big GM fire at Livonia. At least they have some relationship to each other.

Top Management

As a result of the Livonia fire, top managements in industry are considering:

1. The wisdom of concentrating production of a critical part or a whole item in a single huge plant.

2. Additional insurance to compensate for lost production, lost orders, and personnel displacement.

3. Establishment of insurance departments, with the manager held responsible for loss prevention work, or appointment of a company official with that added responsibility.

4. Careful survey of plant procedures to see how they stack up against the factors believed to be responsible for GM's loss.

Building Designers

Also, as a result of the Livonia fire, building designers and engineers want to see:

1. More fire walls or curtains or partitions to divide large manufacturing areas.

2. More complete sprinkler protection.

3. Stricter adherence to safety codes.

4. Engineered processes to reduce the hazards of welding, flammable liquids, smoking, wiring, and heating.

5. More adequate ventilation in roofs.

Plant Safety Directors

Further, as a result of the Livonia fire, safety directors are recommending:

1. Frequent, professional training of fire brigades.

2. Hiring of mentally and physically competent building watchmen.

3. Multiple protection against hazards so that complete reliance will not be put on sprinklers or extinguishers alone.

4. Compulsory fire drills for employees.

5. Increased coordination between safety officials, insurance managers, and top management.

Public Officials

Finally, as a result of the Livonia fire, public officials and civic leaders are urging:

1. Tighter building codes for areas outside city limits.

2. Appraisal of fire hazards by outside agencies.

3. Better cooperation between municipal fire departments and industrial plants, particularly in rural and suburban areas.

Each of the points can be elaborated on extensively. I am sure the readers of the *Quarterly* are better equipped to do that than I am.

The 1953 annual report of General Motors Corporation has one section headed "Fire at Hydra-Matic Transmission Plant," covering one and one-half pages. One paragraph of this report reads as follows:

> "The disaster occurred in a building that had been considered fireproof. Fortunately, GM possessed an organization with the abilities and resourcefulness to make a rapid recovery. Fortunately, too, GM possessed two other proven automatic transmissions which could be quickly modified for use in Pontiacs, Oldsmobiles, and Cadillacs."

The word "fortunately" appears twice in that paragraph. It is certainly true that it was some measure of good fortune for such a fire disaster to be visited upon a company that is as well equipped with dollars, manpower, facilities, and brains to live through it.

It would have been more ill fortune than most companies could have borne. To those companies, a free and valuable lesson in fire protection was given.

What I have said about the good thoughts and good deeds of some in industry in regard to protection unfortunately is far from universal. All of them surely have heard about it. But, it is something easy and convenient to forget when faced with other big and little problems of finance, production, and sales.

I conclude with this thought: It is a continuing responsibility for all associated with the business of fire protection to tell the lessons of Livonia, of fire protection, over, and over, and over. For all who are interested in the problem but who are not directly in the business, the same can be said. We together must make enough of an impact on the minds of management in commerce and industry to accomplish the objective.

Modern Promotion for Fire Prevention*

By Stuart Peabody

Assistant Vice-President, The Borden Company

Our objective is to get into the heads of every man, woman and child in this country an awareness of fire, a resolution to do something about it, and some simple rules on how to go about doing it.

The fire problem breaks down into three general subdivisions: fire prevention, fire detection and fire fighting. Obviously in our promotion program, we are concerned only with the first subdivision. Fire cannot be detected with a pamphlet. Fire cannot be extinguished with an ad. It is possible, however, to stop many a fire from ever starting with a skillful program of mass education. Our promotion, therefore, is aimed at prevention and what we are going to promote is a good idea.

Ideas are a lot harder to sell than products, especially ideas calling for mass thought and cooperation. What we are setting out to do is to put pictures, some of them pretty horrible, into people's minds. Unlike product pictures, which are solid and concrete, we are dealing with abstractions in our campaign. We have the facilities for attracting a very large audience. What we've got to do first is to get a picture into their collective heads of a simple major concept. They've got to be made aware of fires; they must really want to avoid fires.

Only when we have accomplished this first objective can we come in with our secondary attack and get across to them the ideas and rules which will help them accomplish what we have convinced them

NFPA General Manager Percy Bugbee presents first Sparky award to Ad Council chairman Stuart Peabody for the Council's "outstanding contribution to fire prevention education."

they want. Therefore, we can establish as our primary objective, making people fire conscious, and as our secondary objective, giving to them the rules of fire prevention.

The Tools of Promotion

What tools do we have at our disposal to accomplish such a program? Basically, there are three: advertising, public relations, and people.

Under advertising we should include all media, both national and local, radio, television, newspapers, magazines, car cards, outdoor posters, business papers, company publications, motion pictures, direct mail, pamphlets, and word of mouth.

Public relations would include the use of pictures and editorial material to all

*Based on an address by the author at the 58th NFPA Annual Meeting held in Washington, D. C., May 17-21, 1954.

media, and news releases on local activities.

Finally, and more important than either of the others, are people. People who believe enough in what they are trying to accomplish to work at it whole-heartedly, people who will form the committees, plan the local activities, recruit more members and make more converts. These are the tools of the attack.

A Symbol Essential

Having established our objective and checked our tools, some specific techniques should be examined. The first of these has to do with a symbol, a simple, lovable protagonist for the campaign which can work its way into the consciousness and affection of the American people. The Advertising Council has provided you with such a symbol, your friend and mine, *Sparky*. And it is already obvious that *Sparky* is well on his way to national recognition.

There isn't anything particularly new about this idea of symbolizing an idea with a character. Many companies have done it, including my own, the Borden Company. In non-commercial circles, we have *Smokey* the bear, which was also originated by the Advertising Council for the forest fire prevention campaign. Another one you may not yet be aware of, but I think you probably will, is *Alec* the cat who appeared first in some promotion on

Save Regularly
For the Things You Want
THE BANK FOR SAVINGS
NEW YORK'S FIRST SAVINGS BANK
3rd AVENUE - 72nd STREET
"Sparky" says:
Don't Give Fire a Place to Start!
Get Rid of Fire Hazards in Your Home Today!
NFPA
684 · GORM
Riviera

Over ten thousand billboards similar to this one in New York have been distributed country-wide by the Advertising Council as part of the NFPA sponsored fire prevention campaign.

highway safety and bids fair to jump right out of the ads and into public recognition.

What many organizations who have such symbols fail to do is to carefully and consciously set out to make them stick. If you will indulge with me in a short binge with *Elsie,* the Borden cow, we test the penetration of our character twice a year. The research indicates that *Elsie* is at least as well known as any animal character in history, except *Mickey Mouse* and possibly the whale that swallowed Jonah. If I were a betting man, I would give you odds that in recognition by the public, *Elsie* today would be outscored by Eisenhower, McCarthy and one or two others, but she would lead Cohn and Schine by a good margin.

Your symbol must be promoted in every possible way if you want real results. In our case, since 1939, practically no Borden ad has appeared without *Elsie* in it. She also has appeared in every other conceivable form: dolls, games, jewelry and what not. Most of this, in our case, as it will be with yours, costs us nothing, but it develops a tremendous volume of circulation.

So please stay with *Sparky,* who, in my opinion, is as ingratiating and suitable a character as ever has been conceived. Get him into all your promotions. Let him speak for you and work for you constantly.

A Live "Sparky" Essential

Also, and this is out of my own experience, use him live whenever you possibly can. I know there are problems in this. I know from a lot of experience, much of it embarrassing and some of it bitter. The fact is that our *Elsie* really never got to first base in inanimate form. She really began to roll only when she became a living, breathing personality.

The original "Sparky" (shown here) was entrusted to Mr. Stanley F. Withe, Chairman of the NFPA Public Relations Committee (at left), at a "kick-off" luncheon for the Ad Council project in 1952. Mr. Bugbee, NFPA General Manager, whose vision initiated the campaign, is seated with Mr. Withe.

A very brief bit of reminiscence. We started *Elsie* in the year 1936, and for the next three years she proved to be a useful and effective symbol for our campaign. In 1939 at the New York World's Fair we decided to use *Elsie* at our big exhibit. But our concept of *Elsie* at that time was strictly two- and three-dimension. We had her all over the place, in murals, in pamphlets, in pictures, in statues. We also had at this exhibit a corps of information girls and we asked them to keep a record of all the questions that were asked. The first and most frequent question was, "Where is the girls', or boys', room?" The second, which was a little more embarrassing, was, "How do we get to the General Motors exhibit?" But the third one was, "Where is *Elsie?*" We had a perfectly beautiful set of cow barns, 150 pure-bred animals, and a big moving platform to milk them on in public. But it had never occurred to us, up to that point, to personify *Elsie.* Well, we didn't

waste any time. We went back to the barn, picked out a particularly beautiful Jersey named *Eul Dula Belia,* made a blanket with the word *Elsie,* and once a day we cleared all the other cows off our rotolactor and put her on alone. From that time on, she really started to go!

Sparky should be live, whenever it can be arranged, a real live *Sparky* dressed in a fireman's hat. This will bring about a consciousness of what you are trying to achieve which could never be done with words.

Keep Your Message Simple

Another suggestion which is obvious but particularly important in selling ideas, is to keep your message simple. You already have two slogans which are excellent for their simplicity: "Don't gamble with fire; the odds are against you," and "Don't give a fire a place to start."

Simplicity in slogans isn't the only requirement. All of the material must be phrased for immediate comprehension. I am not a believer in the theory that the average intellectual level of Americans is 4 or 6 or 8. I am only saying that when your target is 160 million people you've got to get your message across fast in order to make it stick. People are busier today than they ever were before. They are busy working. They are busy playing. They are very hard to reach with an idea unless the method of delivery and the language of delivery is designed to hit them quick and to stick.

Have you ever stopped to think of how many ideas and products you are exposed to every day? If you will think about this for a moment, you will get an idea of the nature of your competition. Make your message say what it has to say in the shortest terms. Make it apply to the self-interest of your audience.

Another rule of advertising, which is trite but true, is that of endless repetition. In our fire prevention campaign, we should use our symbol and our slogans over and over again. A message as important to public welfare as this one should be pounded and pounded and pounded until all the evidence indicates that results are being obtained.

Work at Grass Root Level

Of equal importance to business, politics and fire prevention is organization at the grass roots. In your fire prevention work you have already made a fine start with the public relations activities of the NFPA, your fire prevention campaign through the Advertising Council, and the work of your Public Relations Committee. However, the success of all of this is completely dependent on the effectiveness of the program at the local level.

A national campaign with inadequate local implementation just won't work. You can't run a truly successful mass education program from Boston, New York or any other single point. You can plan it, you can lay it out, but it must be brought into focus with Main Street, U.S.A., if it's going to get results, if you are going to stop needless fires.

Also, in your work you can greatly improve the effectiveness of the national campaign by using not only ideas and materials supplied from headquarters but by adding to these your own ideas, inspired by and arising out of the local situation. Every area has its own peculiarities, and these can be capitalized on locally by your own ingenuity and enthusiasm. A really well-organized promotional campaign must operate at all levels. When it does it can result in the greatest chain reaction ever invented.

Join Sparky's Fire Department!

Hi kids! You can become a member of my real-life, honest-to-goodness, official Sparky's Fire Department.

When you become a member I will make you an official Inspector and I'll send you the official badge and membership card. You will have to go to your local fire house and have the card signed before you are really and truly a member. Along with the badge and membership card I will send you a special Inspector's Manual which tells you how to prevent fires.

To get your badge, membership card and manual

SEND 25¢ IN COIN OR STAMPS TO

SPARKY'S FIRE DEPT.
BOSTON 1, MASS.

(Sparky's Fire Department is a copyrighted, non-profit project of the National Fire Protection Association as part of its Public Education program.)

A new aspect of the NFPA Advertising Council fire prevention campaign is the enrollment of children in Sparky's Fire Department. This will be announced publicly later this summer.

Another link in the chain reaction of well-organized promotion is the recruiting and development of an army of volunteers who will pass along the spark to friends, relatives, and associates. The NFPA is planning some excellent work in this area with the idea of *Sparky's Fire Department.* This is being developed in

cooperation with the Advertising Council. If we can get millions of kids interested in the *SFD* to the point where they will go to their local fire departments to have their membership cards signed, you are really going to develop a fire consciousness in the youth of America.

I understand that in some of the areas in which this particular idea was tested, some parents actually complained that their kids were heckling the life out of the old man for smoking in bed, leaving oily rags in the garage, and other things like that.

Results Require Research

Next, we should use all the modern research techniques which are available to check and recheck our course. With the best possible planning it is still possible to start down the wrong road if we do not occasionally check direction. All commercial campaigns are constantly checked to make sure the material is still valid and still applicable.

In the case of our fire prevention campaign, we should analyze carefully all the available material at our disposal on the types of fires currently being experienced, and the causes of these fires. Our materials and copy must always be kept up-to-date. We must, however, be selective. There are many more causes of fire than we could possibly get into a single campaign. Therefore, it would seem sound to employ only those types which will do the most to make people conscious of fire, and leave it to their common sense to apply the rules to other causes. Naturally, the causes which are the most dramatic and the most compelling are those which happen oftenest, and the ones most closely affecting the individual. Obviously, a child's death has more impact than a grass fire, and the burning of a home is more compelling than the burning of a factory.

The use of such examples may be sensational, but it is plain promotional common sense. The person who becomes fire conscious because of the tragedy of a child is more likely to be sold on fire prevention everywhere, at home and on the job.

Basically, what I am trying to point out is the impossibility of telling your audience through even the largest promotional campaign all the possible things they should know or look for. If we try this, even over a long period, we will tend to dilute our story and our effort, and we will probably fall short of the mark.

In the case of fire, I am convinced that we've got to deal with strong meat. Once sold on the absolutely catastrophic effects of fire, our prospects will be cured permanently, at least from indifference. Then, if we follow this with our secondary phase, dealing with the rules and specifics of prevention, we are practically assured of saving countless people from fire.

Role of Advertising Council

The Advertising Council is spearheading our national fire prevention campaign.

The Council is a non-profit organization set up by American business to help just such causes as yours by bringing their messages to masses of people. The accomplishment of the Council can best be summed up, I think, in one simple statistic, and that is that last year, through the Council, there was delivered in these public service projects more than one hundred million dollars' worth of advertising.

First rendering of the cover art for a children's Sparky book to be published next January 1 by Rand McNally, Chicago. One of the famous Rand McNally Book-Elf Books, a first printing of 300,000 copies is planned.

My company, along with a lot of others, supports the Advertising Council not only because it gives us satisfaction in helping these causes but because we think it is good business to do so. For the same reason we support the NFPA. We believe that voluntary organizations such as the Advertising Council and the NFPA, can do their respective jobs much better than government bureaus which are used in most other countries.

The Council is helping the NFPA to accomplish its promotional aims in most of the areas we have discussed and has been doing so for about three years. The program has been conducted in all media, and fire prevention messages are being sponsored freely by both national and local advertisers. The total value of the Council effort on the fire prevention campaign, if counted in dollars, would run into millions, and the total circulation of a year's program amounts to billions of impressions.

It is our feeling in the Council that the campaign is getting bigger and more effective every month. Research shows that notable progress has been achieved in making the nine rules of prevention known throughout the country, and certainly the recognition and popularity of *Sparky* have been increased tremendously.

I cite these things not for credit but to demonstrate to you that American business, through the Advertising Council, is giving you substantial backing in your great campaign against fire. However, I want again to make perfectly clear that the Council campaign alone cannot do this job. It can provide a broad attack on the masses of people, but this cannot be effective unless it is implemented locally by every facility at the disposal of the NFPA. The type of support the Council supplies can serve as artillery; it can lay the barrages and it can pound and pound and pound, but if the people are to be made truly fire conscious, the final sale will be made by the local activity of persons who are devoted to the great cause of fire prevention and, particularly, the members of the National Fire Protection Association.

Advances in Operating Room Safety*

By Carl W. Walter, M.D.
American College of Surgeons
Member, NFPA Committee on Hospital Operating Rooms†

The title bears the connotation of progress. Some progress has been made but, as yet, little has been accomplished to bring safety to the patient. We do have a workable set of standards setting forth minimum safety recommendations for hospital operating rooms in NFPA No. 56**. The structural requirements set forth in the standard are readily enforceable, but, paradoxically, they may add to, rather than decrease, the fire and explosion hazards unless the operating hazards are properly controlled. It follows that your most challenging mission is the education of all concerned with the safety of the patient under an inhalation anesthesia.

The explosion hazard is a complex problem in hospital operating rooms because people firmly and persistently insist on being people. While the scientific aspects are simple and straightforward, successful and thorough application of this knowledge is skillfully evaded, although almost everyone concerned makes a fetish of using some small fragment of the established technical data as a balm to his conscience. Despite the faulty control of electrostatic discharges in operating rooms today, accidents are rare. This experience seems to justify the complacency and lack of interest widespread in the profession.

Dr. Walter

The problem exists because gaseous anesthetic agents, to be effective, must be soluble in the lipid membranes of the brain. Unfortunately such anesthetics are also flammable. Flammable mixtures of these agents and oxygen are in common use. Explosive combustion of an anesthetic mixture occurs about 120 times annually with perhaps 30 fatalities, according to insurance carriers. Anesthesiologists record an accident once in 80,000 inhalation anesthesias. The best estimates are that 7,000,000 inhalation anesthetics are given each year—a comparable incidence considering that data of this kind are difficult to compile. The accident rate does not differ materially among various inhalation anesthetic agents in common use.

Negative Influences on Safety

Institutional compliance with reasonable and economical safety measures aimed at the control of electrostatic hazards awaits effective education. Thus far, negative influences have had undue influence. The usual avenues of information (the surgical and building trades) have continued to exploit unsafe materials, equipment and techniques, shirked responsibility for cleaning-up designs and practices, and have failed to take a positive stand in the publicity, advertising and detailing of their wares.

Professional groups which guide institutions in the field (architects, engineers,

*Based on an address presented at the 58th NFPA Annual Meeting, held May 17-21, 1954 in Washington, D. C.

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**Copies available from NFPA Publications Service Dept., 25 cents. May 1954 edition incorporates changes made at 1954 annual meeting.

government services) have been derelict in that they are prone to perpetuate established practice, fall prey to adverse rumor concerning new developments, and fail to visualize the broad functions of materials and equipment in patient care.

Within the hospital, ignorance and negligence often sit at the conference table when decisions are made concerning operating room safety. Too often, safety programs are enforced by incompetent or lax employees with no appreciation of the goal of their efforts.

Local codes are an additional confusing factor. These are often conflicting and impractical. Too few are based upon functional minimal requirements; most accomplish nothing in existing structures; compliance is prohibitively expensive for the results that can be demonstrated.

Factors Producing Explosions

Four conditions existing simultaneously produce explosive combustion of anesthetic gases in an operating room. First, the existence of a flammable anesthetic gas. Second, the presence of oxygen in the air; these two conditions are essential to patient care. Third, a source of ignition; this is the condition that requires rigid control. Heat (365°F. or over) is used in the operating room in the form of flame, electric hot plates, hot wire cautery, photographic bulbs, cigarettes, et cetera. Electric sparks are common. Power and lighting circuits with commutators, switches, receptacles, faulty cords and insulation failures contribute sources of sparks of sufficient energy to be hazardous. Electrostatic discharge of a 1000-volt spark has sufficient heat to cause ignition. The fourth and final factor is human carelessness. It is human carelessness which permits the flammable gas and oxygen to contact the source of ignition. This is too often of willful variety that, to date, evades correction.

Control of the explosion hazard in a situation where all the ingredients of a disaster must often be present demands minimizing the chance of all four conditions being present simultaneously.

Limiting the Hazardous Area

An anesthetic mixture of a combustible gas can be confined to the anesthesia machine and the patient's respiratory passages by using a closed technique of administering the gas. Under such circumstances, the evidence is that a combustible mixture is not encountered beyond a radius of six inches from the gas transmission system and the patient's face. Some anesthetic agents (ether) are present in the liquid phase and are subject to spilling; some gaseous mixtures (cyclopropane) are heavier than air and potentially flammable mixtures may cascade to the floor beneath the anesthesia system and pool on the floor. The hazardous area is therefore defined as extending to a radius two feet from the anesthesia machine and the patient's head and a similar distance above the floor. (NFPA No. 56 Section A-22.)

Once the hazardous area is defined, carelessness on the part of untrained personnel can be mitigated by indoctrinating them on an understandable level to keep away from the anesthesia "stage" (patient's head and anesthesia machine) at all times.

Sources of ignition can be eliminated partly by decree — no smoking, no hot plates, use of Underwriters' Laboratories listed electrical appliances, et cetera; partly by design — locating electrical wiring five feet above the floor out of the hazardous area, providing a means for dissipation of electrostatic charges, et cetera; partly by a studied effort to apply effectively the minimum recommendations contained in NFPA No. 56 at every operation where inhalation anesthesia is used.

Electrostatic Discharges

Electrostatic discharges are credited with the responsibility for the majority of the accidents that occur.

Safety from the electrostatic hazard rests upon a tripod depending for support on (1) proper structure of the operating room, (2) well designed equipment and (3) proper behavior of personnel.

Two principles are involved in control of this hazard: one, to prevent rapid build-up of potential; the other, to provide a conductive pathway over which the inevitable accumulation of electrostatic charge can leak away.

Safe structure is the basis of control in that a conductive operating room floor forms the electrical pathway interconnecting everything and everyone in the room. There has been much confusion in arriving at a specification for a satisfactory floor. Conductivity is but one requirement of a functional floor for operating room use, yet, because it is a relatively new concept and can be measured, it has become the criterion. The suitability of the surface as an electrical contact is of equal import in the role of the floor as an interconnecting pathway. A macroscopically homogeneous surface is essential to insure uniform wear and provide an optimal electrical interface. To eliminate the shock and spark hazard a resistance of more than 25,000 ohms is desirable. Grounding the floor serves no useful purpose in its function as an interconnecting pathway and introduces undesirable electrical capacitance effects.

Safe furniture is made of metal or electrically conductive material. Surfaces on which movable objects may be placed are of unfinished metal. Electrical contact with the floor is established through conductive casters, tires or leg tips. Careless design of furniture often introduces a hazard. Insulating treads on stools or silencing rubbers between the frames and the stainless steel tops of furniture break the conductive pathway. Furniture must

At the 58th NFPA Annual Meeting, Dr. Walter exhibited this Operating Room booth prepared by the NFPA Committee on Hospital Operating Rooms to illustrate the safety provisions of NFPA No. 56.

therefore be tested by measuring resistivity between the functional surface and the floor to detect such faults in design.

Conductive casters are necessary on electrical equipment because it is often moved while disconnected from the power supply. Three conductor cords and plugs provide for routine grounding of the metal frame during use.

Anesthesia machines have two conductive pathways. The first provides electrical continuity between the structure of the machine and the floor as described for furniture. The second envelops the gas transmission system because, contrary to widespread belief, a charge accumulates on the inner surface of passages through which gas is flowing. Metal or conductive rubber is therefore employed to form the transmission system between the various elements of the anesthesia machine and the patient's face. Manufacturers of these machines, prompted by a reactionary profession and faulty government specifications, have been slow to standardize on a safe design or to advise revision of existing equipment. The Underwriters' Laboratories have not established an inspection service for anesthesia machines even though this equipment is the very core of the hazardous area.

Maintaining Conductivity

Maintenance of a conductive pathway requires continued surveillance of the surfaces that provide electrical contact. Nonconductive wax is often applied by the nonthinking. Dirt — bits of broken glass from ampoules or suture tubes, ends of sutures, layers of blood or pus — may accumulate on casters or legs to insulate them from the floor. Replacement of worn conductive parts by the ordinary variety occurs. Periodic testing must be done in the spirit of safety for the patient by an individual who understands that the purpose of the test is more than the mere compilation of a record.

Examples of Electrostatic Control

Details of techniques are essential to safety. Three instances suffice to illustrate how proper techniques provide safety.

Operating tables cost $1,500. Conductive casters establish a conductive pathway to the floor. A $50 sponge rubber mattress is isolated as a dangerous potential by the application of a conductive rubber mattress cover. However, to prevent the discomfort of a chilling contact, a cotton sheet or blanket is stretched over the mattress before the patient is put on the table. By this last unthinking act, the whole purpose of the safe structure, furniture and equipment is negated because the blanket insulates the patient and increases the capacitance of the system markedly. Discharge of whatever potential accumulates on the patient may well occur in the hazardous area between the patient's face and the conductive anesthesia apparatus or the anesthetist. This is particularly true at the end of the operation when the aseptic field is being removed and previously bound electrostatic charges are abandoned to dissipate themselves. A 35-cent conductive strap fixed permanently to the metal frame of the table where it can be thrown across the bare skin of the patient's shoulder or leg to bridge the insulating textile, provides safety. Yet no manufacturer supplies this essential detail or even advocates its use! Only a few hospitals enforce this technique.

Basins for glove washing are a part of the aseptic field. These basins are supported on a metal stand, draped with several thicknesses of sterile textile. The basins are thus effectively insulated from the conductive pathway. When germicide or detergent solution is poured into the basins from a glass container, a charge accumulates that may dissipate itself as a two-inch spark to the first hands that are thrust into the basin. A little solution

spilled over the rim of the basin wets the textile and forms a conductive pathway.

Neither the National Electrical Code nor NFPA No. 56 specifies a satisfactory plug and receptacle combination that permits portable surgical electrical appliances to be used in operating rooms everywhere. As a result adapters are improvised to permit the use of surgical equipment carried from hospital to hospital by the surgeon. His equipment is often fitted with domestic caps as a compromise by manufacturers who have no way of determining the type of receptacle used in a particular hospital. Specification of a standardized waterproof plug is an urgent need.

Importance of Human Behavior

Safety depends upon human behavior and integrity in six areas.

Personnel must be trained to stay away from the anesthesia machine and the patient's head.

The philosophy of slow, deliberate motion must be drilled into personnel, particularly anesthetists. An electrostatic charge can accumulate only when the rate of generation exceeds the rate of dissipation over the conductive pathway. Slow motion in the hazardous area becomes an important safeguard where contact with the conductive pathway is marginal.

Dangerous fabrics must not be worn. Freshly laundered cotton is essential for both electrostatic control and aseptic technique. The build-up of electrostatic charge on wool and synthetic cloth is so rapid that these materials are outlawed except when the entire garment is worn in direct contact with the skin, which serves as the leakage path for the dissipation of the charge. For example, nylon hose present a hazard until the soles are moistened with perspiration; a petticoat, on the other hand, is dangerous, because the free hanging skirt becomes charged through motion. Synthetic material is such a good insulator that the charge remains even though the bodice is in contact with skin.

There must be personal responsibility for maintenance of a conductive contact with the floor. Conductive soled shoes, conductive booties or slip-ons are effective only when they are worn. They must be tested daily because dirt collects on the bottom to destroy the electrical contact. A testing device and an inverted wire brush fixed to the floor should be standard equipment at the entrance to every operating room corridor so that faulty contact can be detected and corrected.

Because dirt interferes with electrical contact, personnel must be trained to keep the floors clean. The surgeon who discards suture ends to the floor, the nurse who drops broken glass or fails to clean up blood or pus before it is tracked about contributes to the hazard.

It is almost superfluous to mention control of sources of ignition such as cigarettes, flames, sparking electric appliances and the like, yet offenses of this type are common.

A complex problem in education is defined by an analysis of the electrostatic hazard in the operating room. Put in its proper perspective, the hazard is the cause of minute mortality. That due to cardiac arrest during anesthesia is 2500 percent greater. Time, effort and money are more wisely spent in providing adequate sterilizers, vacuum cleaners, surgical lights, anesthesia machines and indeed operating rooms themselves to combat an appreciable surgical morbidity and mortality.

Pamphlet No. 56

The motivating philosophy of the National Fire Protection Association's Committee on Hospital Operating Rooms has been to establish functional standards that reduce the explosion hazard to a minimum. Most of the provisions are qualita-

tive and point the way to economical prevention of the rare death. It has served to crystallize the application of knowledge, so that an intelligent choice can be made in favor of safe materials and techniques. It has pointed out the need for redesign of equipment based on the concept that safety is also a part of function. The absurdities of elaborate explosion-proofing, excessive ventilation, high humidity and electrostatic detection have become obvious as the various members of the committee, with backgrounds foreign to surgery, have come to recognize the special orientation of the problem in the operating room.

The most important factor in safety is building an attitude in the staff that is alive to the hazards and recognizes personal responsibility for the safety of all patients. Safety cannot be legislated into the surgeon-patient relationship. Young people and junior members of a staff are cooperative and extend their concept of patient care readily. Careless disregard for such refinement is frequent among the senior members and administrators. These groups have "gotten away" with current practice so often that they feel exempt from electrostatics as a source of ignition and feel that lightning doesn't strike often enough to warrant precautions.

This problem in safety education has multiple parameters that must be defined in each hospital by asking questions. Once the philosophy of the institution has been discovered and the dominant personalities identified, a program enhancing safe structure, equipment, appliances and behavior can be developed that elicits cooperation. An objective, non-professional approach by specialists in safety — meaning any NFPA member—can mold opinion to unite a staff behind a continuing drive against the carelessness and complacency that create the explosion hazard.

NFPA Pamphlet No. 56 merits your best efforts.

A Dissection of NFPA*

By Merwin M. Brandon
Vice-President, Underwriters' Laboratories, Inc.
Chairman, NFPA Electrical Section

Dissection is normally taken as a medical term with some rather unpleasant connotations. Mr. Webster, however, says that dissection is also "the act of analyzing critically" and I choose that definition.

This idea of a critical analysis of the NFPA came about through three seemingly unrelated occurrences that set a train of thought in my mind. The first was around 1934 when we had the World Power Conference and engineers from all over the world came to the United States. Many of them visited at Underwriters' Laboratories. They were interested in testing for safety. They were interested in the operation of the NFPA and anything related to safety.

As a consequence, I had a great deal of discussion with these people and I found that, for the most part, they were government employees. They thought that the only way to run a safety program was through the government, because it was the only way that would work. That, to them, was obvious. But, I also found that

*Based on an address by the author at the 58th NFPA Annual Meeting held in Washington, D. C., May 17-21, 1954.

they did not have access to the factories of Europe and Asia such as we have in this country. They could see them under only very restricted conditions. The fact that we could go to any factory in the United States and be welcome just was inconceivable to these people.

They spoke English, very good English indeed, but the words that they used and the same words I used didn't have the same meaning. Our backgrounds were so different. It reminded me of the man who was told by his wife that the school thought their child ought to have an encyclopedia. He got quite huffy over it, and said, "What's the use of spoiling the kid? Let him walk to school like I did when I was a boy."

The next occurrence was when the Chinese government (at that time the Nationalist government under Chiang Kai-shek) sent to the Laboratories an engineer from their Bureau of Standards. He was an intelligent man, well educated, having graduated from the University of Belgium. He spoke as good English as any of us. Instead of staying a month (as was his plan) he stayed six months because he got so interested in our operations and how things were done. I had a great many talks with the man, and, again, I tried to analyze the NFPA, the National Electrical Code, the regulations that flow from the NFPA in other fields, and the operation of Underwriters Laboratories.

The man had absolutely no comprehension of what I was saying. As a matter of fact, he told some of our people in San Francisco, as he was going out of the country, that I was trying to make a Christian out of him. He could not understand that we were clear-sighted people who have set up a system of voluntary operation whereby the good in all of us had an opportunity to express itself in a practical manner.

Maybe I ought to have stopped right there and figured, "Well, it's been an interesting set of experiences," content that my own thinking had been clarified, and not bothered about anything else. But about that time, or shortly thereafter, Congress began its investigation of Communist penetration into our country and into our government. I was shocked and horrified on reading Miss Elizabeth Bentley's testimony.

Here was a woman who had every advantage that our country could offer her. She had good social background; she was intelligent; she was educated at private schools. Yet she had joined a group of people whose avowed object was the forcible overthrow of the whole form of government that had made her existence possible. It puzzled me. I couldn't understand it.

I read her testimony in the New York Times most carefully. It seemed to me that what had happened was that this woman had gone to a private school where her instructors were conscious of the fact that she was one of the fortunate people on earth. They tried to give her some picture of the distress that existed among the less fortunate in our country so that she wouldn't be like Marie Antoinette, who said when they didn't have bread, "Let them eat cake." They didn't tell her anything except things that were bad about our country. In fact, she made the statement that up until the time of that investigation she had never heard anything good about this country.

That was a horrifying statement. I began to wonder: "What have I done to

tell people about some of the good things of this country?" It seemed to me that every time I wrote a letter, it was to complain about something. Maybe, I thought, I'd better start talking about some of the good things. What have I ever told my own son about the things that make this country great? Most of the time I was griping about something he didn't do, or at least claimed he didn't do.

I figured I'd better get busy and start a campaign to tell people about the constructive things being done in this country of ours — the good so outweighs the bad. I knew I might be accused of being a sentimentalist; I might be accused of being a softie; but, at least, I was going to tell about something in which I firmly believed.

Evidently other people had the same realization. I noticed that President Eisenhower, in greeting General Dean on his return from captivity, stated his concern over the lack of understanding among our young people as to what this country stood for so that, when the time came for sacrifice, as it must come to every generation, they would move out with confidence, feeling that they were defending something that was unique in the history of the earth and once lost might not be regained until after centuries of persecution.

In considering organizations that contribute to the American way of life and epitomize the American way of life, I would certainly place the NFPA. I say this with no desire to flatter the NFPA staff and those members who contribute so much to the efforts of the NFPA. You know what the NFPA is, but I wonder if you have examined it as I did with eyes newly opened by the challenge of alien ideologies that are nothing but a recrudescence of the cruelty, the savagery and the tyranny that we associate with the Dark Ages of human existence.

With that thought in mind, let us examine the NFPA: What is it? What does it do? How does it accomplish its results?

The NFPA was formed by a few far-seeing people who realized that cooperation was a more potent force than compulsion. They realized that here was a country moving ahead, vigorous, with a wealth of timber; as we use wood in all of our homes and in all of our structures, we were, therefore, a natural for fires and conflagrations. They also realized that when we had fires, despite the blessing of what we know as fire insurance, our country suffered a loss of wealth: using wealth in its proper sense as a result of man's labor for man's benefit.

They realized further that despite the fact that we came from every race and creed on earth, we were fundamentally a Christian people and that we would cooperate for the common good without any immediate financial benefit in view.

That was a great deal indeed, and I say that I thank God for those people.

Now, let's see how the NFPA operates. What did they do? They formed an association and that association has grown in numbers, has grown in prestige until the people of this country have at their disposal a tremendous amount of technical information, a group of people trained in fire protection and available at all times to work for the public welfare.

This is probably known to each of you, just as well as it is known to me, but sometimes we get so fixed in our particular orbits that we don't stop and stand back and take a look at the situation from a broad point of view.

I have, for twenty-six years, worked with and for the Electrical Section of the NFPA. I know something about its operations. I know something about its enormous contribution to this country. The National Electrical Code is nothing but a set of installation requirements designed to make electricity safe. It is prepared by every segment of the electrical industry with but one end in view, and that is, safety to the public.

What does that mean from the standpoint of economics? First, I think you have to go back to the setup of our country. The people who founded our country realized that all civilization, all nations had suffered from abuse from some central authority. They therefore set up a system of local autonomy whereby the local people could decide for themselves what was safe for their area. In other words, they believed in the intelligence of the common man. I share that belief with them.

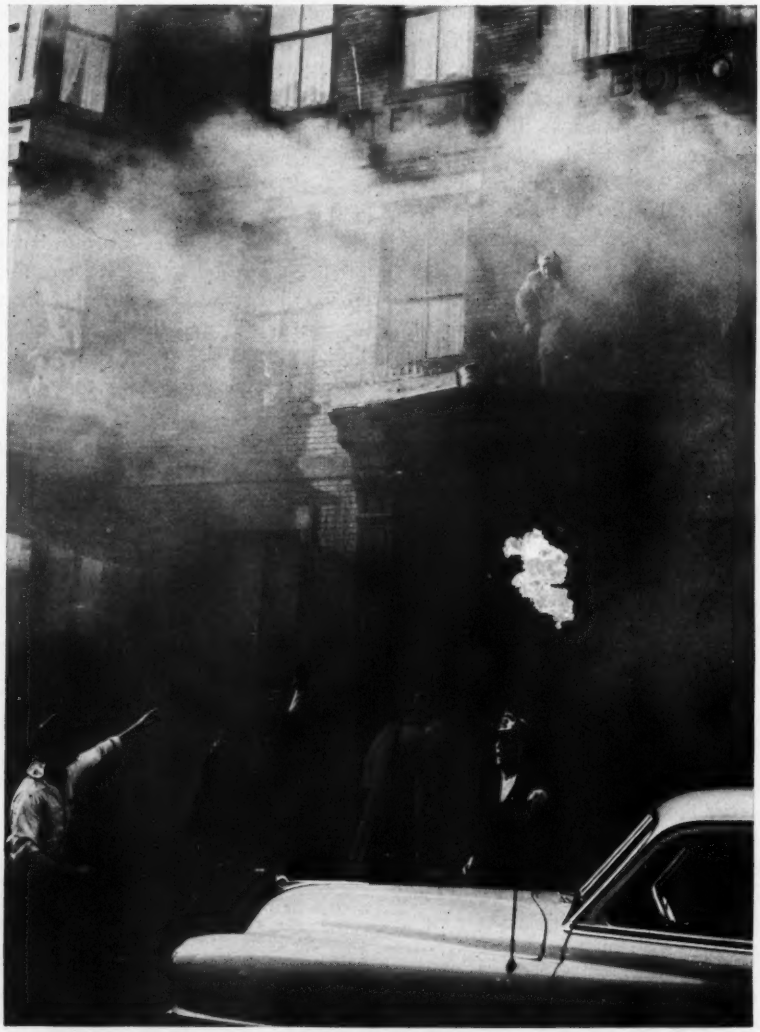
These local subdivisions could pass almost any type of law they want. They could pass rules that would completely stop the flow of commercial traffic. Our federal government could no more tell New York City what kind of safety regulations they must have than I could and get anywhere with it. This is a very sound provision.

Actually, local governments do not issue excessive requirements. In the electrical field they depend on the National Electrical Code, and practically every city in this country uses the National Electrical Code as a basis for its regulations of electricity for safety. It can be modified on account of local pressures or local conditions, but, nevertheless, they do use that Code.

What does that mean to the economy of our people? It means that manufacturers, in producing, have some idea of what safety requirements they must meet in the different sections of the country and they can produce for distribution throughout the country. That means mass production and a high standard of living for our people, and that is one of the direct contributions of this Code and, I dare say, many other codes put out by the NFPA.

If you think that is not a contribution, you need merely look to Europe where they are struggling frantically to break down the barriers that they have set up over the years so that each country produces for itself alone and has to produce something different for the other countries. They have an organization there that is trying to get unified requirements for a large area, such as we have. We have aided them with technical help. We have aided them with a considerable amount of our money, so they will achieve the condition that we have achieved as a free people trying to help ourselves.

That, to me, is certainly a contribution of the first order, and I think the NFPA can take pride in it. Whether or not you agree with this analysis, I hope you will join with me in speaking out freely and frankly about the good things of our country so that we can continue to enjoy the benefits of free enterprise and government operation will be kept in those areas where the spirit of our people has indicated that it is necessary or desirable.



DON'T JUMP by Roland P. Oxton, Boston American staff photographer, was the top photo in the 1953 Fire Foto of the Year Contest. Oxton won First Prize ($250) for this story-telling picture taken at a Boston apartment house fire which killed three occupants the morning of June 24, 1953. An incendiary fire, the two men responsible were later convicted and sentenced to life terms for murder and arson through the efforts of the Boston Fire Department's arson squad. (Speed Graphic, Super Ortho Press, 1/400, f.5.6.)

1953 Fire Foto of the Year Contest

Roland P. Oxton, *Boston* (Mass.) *American* photographer, won first prize of $250 in the Fourth Annual Fire Foto of the Year Contest sponsored jointly by the National Press Photographers' Association and the NFPA.

Second prize of $100 went to William Hawkins, *Pueblo* (Colo.) *Star Journal,* for his photo of a collapsing building in a pre-dawn holocaust.

Joe Lafferty, *Beaver Falls* (Pa.) *News-Tribune,* took third prize of $50 for his photo, "God, Please Save My Home," showing the feelings of a young woman watching the flaming destruction of her home and possessions.

Honorable mentions went to: Harold S. Spicer, *Baltimore* (Md.) *News-Post,* for his photo of an 18-alarm fire in Baltimore, and Theodore Lau, *San Diego* (Calif.) *Union Tribune,* for his humorous shot, "Comfort Comes First."

First Prize Winner

Oxton, 38 years old, is a frequent photography prize-winner. "Don't Jump" recently took third place honors in the Editors & Publishers National Spot News Photo of the Year Contest. This same photo won second prize in a Boston News Photo Contest.

Oxton caught his prize-winning photo on a routine call. "I work on the midnight to 8 a.m. shift cruising about Boston in a police radio- and telephone-equipped car. Late in the morning of June 24, 1953, I received a call that an alarm of fire was in from Isabella Street, in the South End of Boston. We were fortunate enough to be within a half-mile of the street and we reached the scene in about two minutes. The first fire apparatus arrived as we pulled up. Just as we got out of the car I saw a woman on a ledge over the entranceway, screaming that she was going to jump. The two firemen on the left of the picture were pleading with her to stay where she was . . . the fireman on the right was yelling for a ladder to be brought up. It was at that moment that I shot the picture."

Second Prize Winner

W. H. "Bud" Hawkins was called out of bed at 4 a.m., August 29, 1953, and braved falling stones and streams of water to get his photo entitled "There She Goes." Said Hawkins, "It was complete confusion. The fire was roaring through the Central Block, a five-story red sandstone building. Stones, some of them as heavy as 500 pounds, were crashing down all around the building.

"I was inside the police cordon trying to wipe some of the water off my camera when I heard a loud rumbling. I looked up and saw a two-story section of wall starting to lean over. I'll admit I was scared, because it was about to fall on me, so I took one quick shot, turned and ran like heck! When that wall crashed, it smashed up a fire engine I had been standing next to just a few moments earlier."

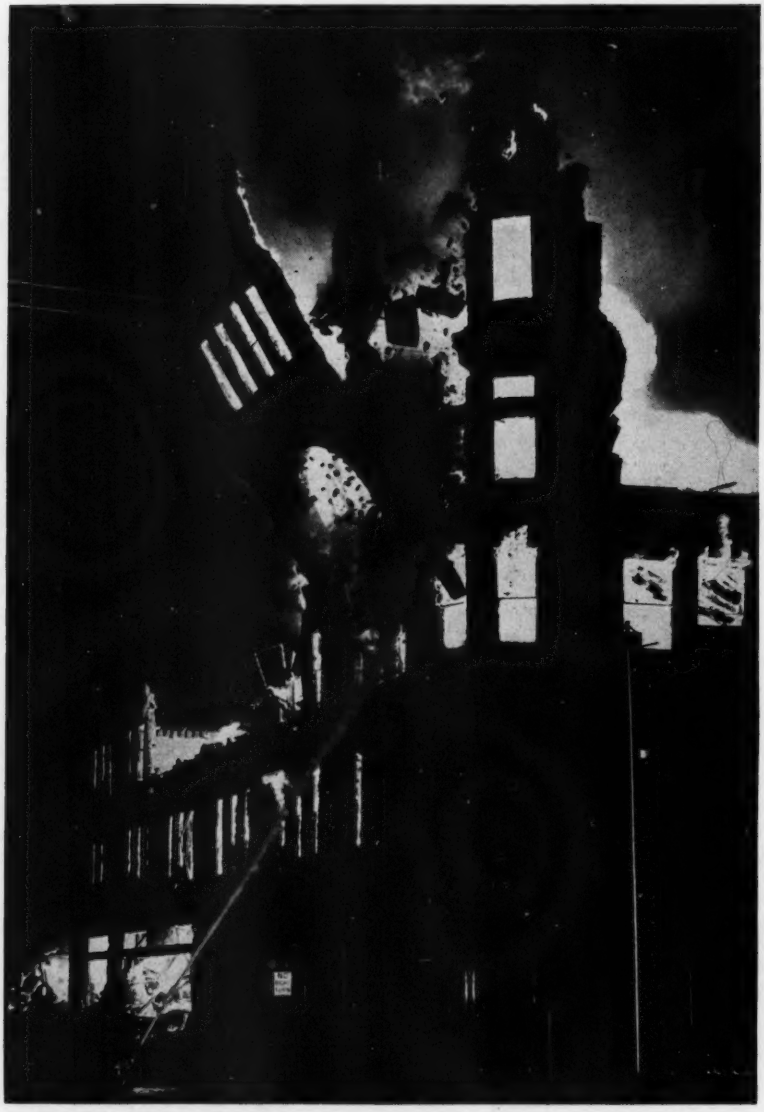
Third Prize Winner

Joe Lafferty, who won third prize honors for his photo of a young, grief-stricken woman viewing her fire-damaged possessions, is also used to coming up with prize-winning photographs. Last year he won third prize in the "News" classification of the Press Photographers' Association of Pittsburgh and had previously won several honors in A.P. Photo Contests in his state.

In addition to the prizes, attractive certificates were awarded to the winning photographers and their employers.

Judges for the Fourth Annual Fire Foto of the Year Contest were: Joseph Costa, *King Features* and Chairman of the Board, NPPA, Norris Harkness, president, Photographic Society of America; Richard Anderson, editor, *Metropolitan Sunday Newspapers, Inc.;* William C. Eckenberg, *New York Times;* and Percy Bugbee, NFPA general manager.

The top prize winning photographs, the honorable mentions and a selection of 19 others of interest are published herein. Readers interested in obtaining copies of any of the pictures should write to the identified photographers, not to the NFPA office.



Second Prize ($100) in the 1953 Fire Foto Contest went to W. H. "Bud" Hawkins of the Pueblo (Colorado) Star-Journal for this picture of a $760,000 fire in downtown Pueblo, August 29, 1953, which destroyed three buildings housing two hotels, 10 stores and many offices. One person was trapped and killed in the blaze. (See October 1953 Quarterly, Frontispiece, and January 1954 Quarterly, page 308.) (Speed Graphic, Super Pan Press Type B, Strobe-lighted, 1/100, f.3.5.)

This photo of a grief-stricken young woman watching the flaming destruction of her home and possessions won Third Prize ($50) for youthful staff photographer Joe Lafferty of the Beaver Falls (Pa.) News-Tribune. In addition to his newspaper work, Lafferty still finds time for a daily 60-mile commute to the University of Pittsburgh where he is a student. (Speed Graphic, Panchro Press B, 1/100, f.16, Strobe-lighted.)

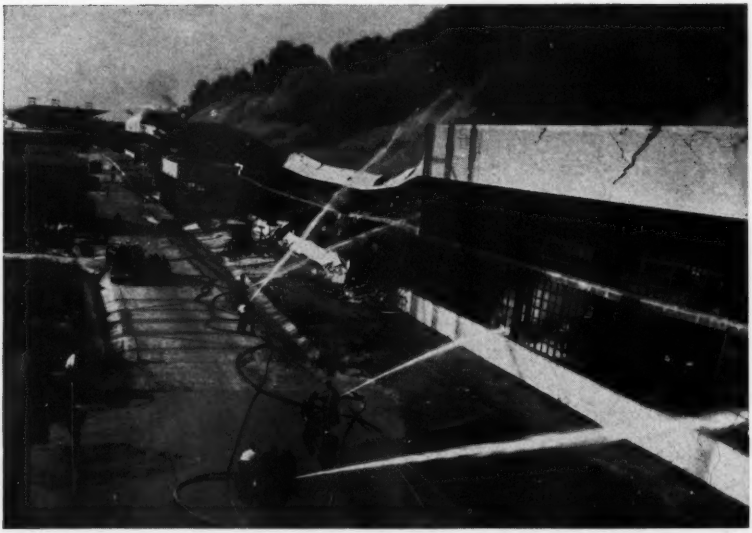
Honorable Mention was awarded Harold S. Spicer of the Baltimore (Md.) News-Post for this picture of a ship supply store blazing out of control during the $800,000 Chesapeake Marine Railway Co. fire in Baltimore February 17, 1953 (see January 1954 Quarterly, page 262). Two other views of this same fire, including another shot by Spicer, are on page 53. (This photo — Speed Graphic, Tri-s Pan, 1/200, f.8.)

COMFORT COMES FIRST is what Theodore L. Lau, San Diego (Calif.) Union Tribune photographer, calls this picture which won an Honorable Mention in the Fire Foto Contest. The old man is running from a fire which occurred in San Diego on June 5, 1953. Lau, himself, first called in the alarm on this one — using the mobile telephone in his press car. (Speed Graphic, Super Pan Press Type B, 1/100, f.8.)

On April 18, 1953, fire extensively damaged the 18th through 21st levels of this 36-story, fire-resistive building under construction. (See January 1954 Quarterly, page 319.) Only commendable work by the Dallas Fire Department prevented the loss from exceeding $500,000. This unusual view was shot by Norm Bergsma of the Fort Worth (Texas) Press. (4x5 Speed Graphic, Super Panchro Press Type B, 1/100, f.11.)

John P. Callahan of the Providence (R.I.) Evening Bulletin took this picture titled "Amen" as firemen were cleaning up. The Sacred Heart Church of Pawtucket, Rhode Island was completely gutted by fire which started in the early morning hours of January 19, 1953. (4x5 Speed Graphic, Super Panchro Press Type B, #5 bulb, 1/50, f.11.)

Everybody got into the act in "Grass Fire" which is what Ed Johnsey of the Dayton (Ohio) Journal Herald calls this picture taken in June, 1953. (4x5 Speed Graphic, Type B film, #5 flash, 1/100, f.8.)



Erik Styrlander, Detroit News staff photographer, took this sharply defined photograph of the GM plant burning in Livonia, Michigan on August 12, 1953. (See October 1953 Quarterly, page 105.) (Speed Graphic, Super Pan Press, 1/100, f.11.)

Fred L. Tonne, Milwaukee Journal photographer, caught a stage effect in this shot of the Milwaukee "Town Club" burning November 5, 1953. (4x5 Pacemaker Graphic, Super Pan, 1/2, f.8.)

Three lives were lost in the Boston apartment house fire at which this picture was taken on June 24, 1953. The two incendiarists responsible for the fire have since been sentenced to life imprisonment. Boston Globe photographer John J. Landers calls this picture "Don't Leave Me." (Speed Graphic, Super Pan, 1/200, f.8.)

Water was scarce when Win Freund of the Wausau (Wis.) Record Herald took this picture "For the Birds" on September 24, 1953. Only this bird house and other buildings surrounding a $20,000 home afire from a defective oil heater were saved while the house burned unchecked. (Contax II, Plus X, 1/100, f.6.3.)

Fire destroyed a five-story, brick, wood-joisted burlap bag factory on August 21, 1953 in Philadelphia, Pa. An overheated motor on a bag-folding machine was the cause. Howard J. Hamburger of the Philadelphia Inquirer called his picture "Street Scene." (Speed Graphic, 1/100, f.8.)

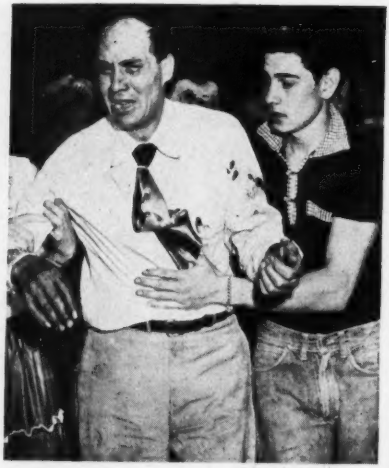
"Silhouette" was shot by Stephen Lasker, NBC-TV photographer at a Chicago produce market fire January 10, 1953. (Speed Graphic, Super Pan Press B, 1/25, f.4.7)

According to the NFPA Handbook of Fire Protection, over a third of the fires in bowling alleys are caused by careless smoking and handling of matches. This general alarm shot was taken September 8, 1953 in Canton, Ohio, by photographer Cliff Haga of the Canton (Ohio) Repository. (4x5 Speed Graphic, Kodak Super XX, 1/200, f.11.)

Hans Marx of the Baltimore (Md.) Sun chanced upon this fire while on his way to work on February 17, 1953. Delayed detection resulted in an $800,000 loss to the Chesapeake Marine Railway Co., et al. (See January, 1954 Quarterly, page 262.) (4x5 Speed Graphic, Super Pan Press B, 1/30, f.11.)

Another view of the Baltimore shipyard fire taken by Harold Spicer whose other shot of the same fire won an honorable mention in this contest (See page 44). Harold Spicer of the Baltimore News Post used a Speed Graphic. (1/100, f.11.)

Ted Needham of the San Francisco (Calif.) Examiner caught at least one moment of humor during a San Francisco hotel fire of July 29, 1953. All the hotel's tenants had scampered to the street dressed as they were when the fire broke out. (4x5 Speed Graphic, 1/200, f.11.)



Severely burned on the arms, this father is held back following an attempted rescue of his 15-year-old son trapped in a basement bedroom. The picture was taken June 9, 1953 in Denver, Colo. by Bill Peery of the Denver Rocky Mt. News. (4x5 Speed Graphic, Pancro Press, 1/200, f.16.)

Bud Gray of the Los Angeles (Calif.) Mirror took this photograph of a fireman collapsing after rescuing a man from a Los Angeles tenement. The fire which took one life occurred October 5, 1953. (4x5 Speed Graphic, 1/400, f.16.)

Five people died despite the excellent ladder-rescue work of Boston fire fighters at this apartment house on November 5, 1953. Picture was taken by Leroy Ryan of the Boston Post. (4x5 Speed Graphic, Super Pan Press, 1/25, f.4.5.)

Water is important in more ways than one to a fire fighter. Here volunteers fighting a feed warehouse fire in Intercourse, Pa., receive a welcome drink from helpers. This picture was taken by Edgar Sachs of the Lancaster (Pa.) New Era. (Speed Graphic, 1/100, f.16.)

Christmas 1953 was a tragic one for two families whose house burned to the ground in this fire only three days before Christmas. The picture was made in Clark Mills, New York, by Dante O. Tranquille of the Utica (N.Y.) Daily Press. (4x5 Speed Graphic, Pan Type B, 1/100, f.8.)

"Moving Night" is the title of this picture of the hurried evacuation of a dwelling on fire on December 8, 1953. Harlin D. Smith of the Sacramento (Calif.) Bee is the photographer. (Speed Graphic, Type B panchromatic, 1/100, f.8.)

Classifications of Flammable Liquids*

By J. S. Queener, Chairman

NFPA Sectional Committee on Classification, Labeling and Properties of Flammable Liquids†

The NFPA Sectional Committee on Classification, Labeling, and Properties of Flammable Liquids has been aware for some time of the existence of strongly divided opinions on how the flash points of flammable liquids should be determined. There are many who believe the closed cup method[1] is the only one that can be accepted. There are many others who feel just as strongly that the open cup method[2] is correct. A committee of the American Society for Testing Materials is currently working on a new open cup method which may be more generally accepted than the present test procedure.

As questions have continued to be referred to our Committee, it has become evident that an even larger problem exists in standardizing on classifications.

In the NFPA "Suggested Ordinance for the Storage, Handling and Use of Flammable Liquids" (NFPA No. 30-L), classification is based on a closed cup determination of flash point. Class I includes those liquids with flash points at or below 20°F; Class II, above 20°F to 70°F; and Class III, above 70°F to 200°F. In another NFPA Standard covering "Warning Labels for Containers of Flammable Liquids" (NFPA No. 326), classification is based on the open cup determination of flash point. Class I includes those liquids with flash points at or below 20°F; Class II, above 20°F to 80°F (not 70°F); and Class III, above 80°F to 150°F (not 200°F).

One might reasonably ask, "Why the inconsistency?" Some might answer that No. 30-L is for storage and processing while No. 326 is for packaging and transportation; but, No. 326 also involves the storage and use of flammable liquids. There is no question that the practices which have been followed have a long established and generally satisfactory history, but does that mean standardization is not desirable?

At a meeting of our Committee in New York in November 1953, it was unanimously agreed that classification of the fire hazard characteristics of flammable liquids should be restudied. Concern was expressed on variations in present classifications and the lack of standardization. Other Sectional Committees of the NFPA Flammable Liquids Committee have requested changes and uniformity in the existing classifications which were

*Based on an address by the author at the 58th NFPA Annual Meeting held in Washington, D. C., May 17-21, 1954.

†Mr. Queener is also Manager of the Safety and Fire Protection Division of E. I. duPont deNemours & Company, Inc.

[1]See NFPA National Fire Codes, Vol. I or American Society for Testing Materials, ASTM Book of Standards, Part 5.

[2]See ASTM D92-52, Standard Method of Test for Flash and Fire Points By Means of Open Cup, published in ASTM Standards, 1952, Part 5, American Society for Testing Materials, 1916 Race St., Phila., Pa.

felt inadequate to encompass all the fire hazard characteristics of flammable liquids. This dissatisfaction has emanated from enforcement officials, industry, and insurance groups.

To more clearly establish the need for standardization, mention should be made of some classifications other than the two NFPA Standards previously referenced.

NFPA Standards for Safeguarding Dry Cleaning and Dry Cleaning Plants (NFPA No. 32) follows still another classification method, not one directly related to flash points but based on a schedule developed by the Underwriters' Laboratories.[3] This involves a numerical scale of hazard ranging from 0-100.

Two insurance groups choose still different systems of classification based on the closed cup method. The Factory Mutuals have a special class of flammable liquids with flash point below 80°F and a boiling point below 125°F; Class I, below 80°F and a boiling point of 125°F or higher; Class II, 80° to 200°F; and Class III, above 200°F. The Factory Insurance Association divides flammable liquids into two classes—Class I, liquids with flash points below 110°F and Class II, those above 110°F.

There is a large group which generally prefers the open cup method and classifies, broadly, a liquid as being flammable if it has a flash point of 80° or below. This group includes the Interstate Commerce Commission, the International Air Transport Association, the U. S. Civil Aeronautics Board, the U. S. Coast Guard, the U. S. Post Office and the Manufacturing Chemists' Association. The United States Army, Ordnance Department, considers a "volatile flammable liquid" as one whose vapor can be ignited at or below 100°F (closed cup). Without pursuing the matter further, it is evident that there are many variations in classifications among various regulatory and advisory authorities.

The flash point of a flammable liquid is obviously of major importance in determining the fire hazard of a liquid and should be a component of any classification system. Some advocate it as the complete measure of the fire hazard and there is no denying that it has been a trade custom for many years to regard it as the criterion. Before any change in classification, now based solely on flash point, can be justified or accepted, it must, however, be demonstrated that the change furnishes a better basis for determining the fire hazard characteristics of a flammable liquid. The need for change is not minimized by the fact that so many groups now using flash points as a basis for classification do so on widely different scales.

A simple definition of a "flammable liquid" is any liquid whose vapor will burn. Intentionally, the reference to flash point is omitted. It would seem logical to consider next the physical and chemical properties of a flammable liquid which constitute its fire hazard characteristics. The following may be considered as the most important to indicate the scope of the problem:

1. Flash point
2. Fire point
3. Flammable or explosive limits
4. Vapor pressure
5. Auto-ignition temperature
6. Boiling point and range
7. Heat of vaporization
8. Heat of combustion

[3]For details see Bulletin of Research No. 29 (June 1943) on "Classification of the Hazards of Liquids" issued by Underwriters' Laboratories, Inc., 207 East Ohio St., Chicago, Ill. Ether is rated at 100, gasoline 90-100, alcohol (ethyl) 60-70, kerosene 30-40, and paraffin oil 10-20.

9. Burning rate
10. Viscosity
11. Liquid density
12. Solubility in water
13. Toxicity of products of combustion
14. Surface tension
15. Spray flammability
16. Vapor density
17. Specific heat
18. Chemical stability
19. Chemical structure
20. Dielectric constant (static hazard)
21. Incompatibility
22. Flame propagation
23. Spontaneous heating
24. Catalytic influences
25. Corrosiveness

Consideration might also be given to certain environmental aspects having an influence on the fire hazards of flammable liquids such as:

1. Ambient temperature
2. Ambient pressure
3. Confinement
4. Quantity
5. Exposure
6. Condition of use

These features, however, are not inherent characteristics of any liquid and therefore should not be included in any attempt at classification.

A review of the first listing indicates possible tripartite grouping of hazards under such headings as: (1) susceptibility to or ease of ignition, (2) severity after ignition, and (3) control or fire-fighting. Without regard to such possible groupings, however, several characteristics seem to be of exceptional importance:

1. Flash point
2. Fire point
3. Flammable or explosive limits
4. Vapor pressure
5. Auto-ignition temperature
6. Boiling point and range
7. Heat of vaporization
8. Heat of combustion
9. Burning rate
10. Viscosity
11. Liquid density
12. Solubility in water
13. Toxicity of combustion products
14. Surface tension

At a recent conference of fire protection authorities sponsored by our Committee, it was concluded that while flash point is a very important fire hazard characteristic of itself, it is not necessarily a sufficient measure of the degree of the fire hazard of a liquid and that further study should be undertaken.

Perhaps there may be a formula which, although complex in itself, would not require complicated application. Certainly a more definitive form of fire hazard classification would have to meet the following conditions: (1) identify hazard under all conditions, (2) be generally acceptable, (3) possess uniformity, and (4) be adaptable to simplified use.

Present classifications do not meet the needs of all groups interested in fire prevention, fire protection, and fire fighting. If standardization can be effected it should be a real service to the process designer, transportation and storage groups, the underwriter, inspection and fire protection authorities, and the fire fighter. Finding a solution is a definite challenge.

Where we shall go from here will depend in a large measure on the interest of fire protection authorities in the subject. Standardization has become a necessity in our way of life and there is no reason for an exception in the classification of flammable liquids. Further study will have to be undertaken and no easy answer is expected as witnessed by the many variations in present classification. Your comments, suggestions, and ideas will be most welcome to our Committee. Address any letters to the Committee Secretary, Mr. Miles E. Woodworth, at the NFPA Executive Office.

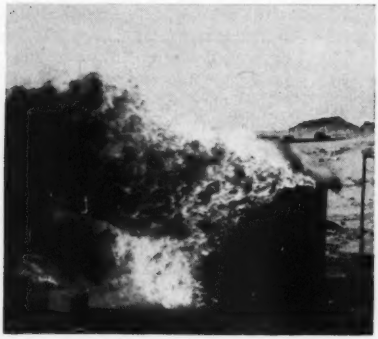


Figure 1

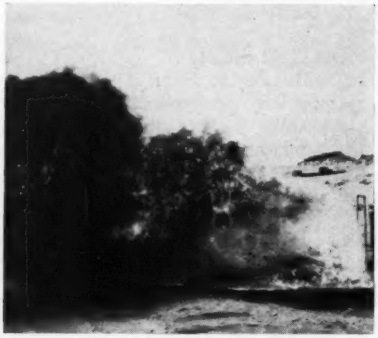


Figure 2

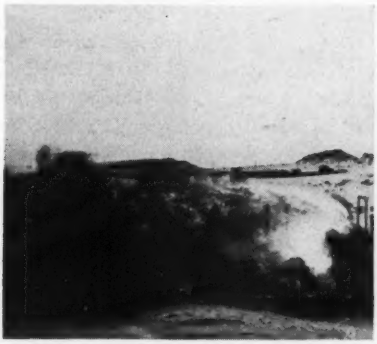


Figure 3

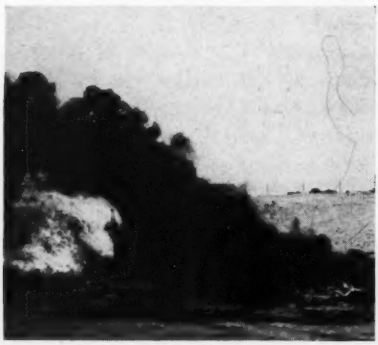


Figure 4

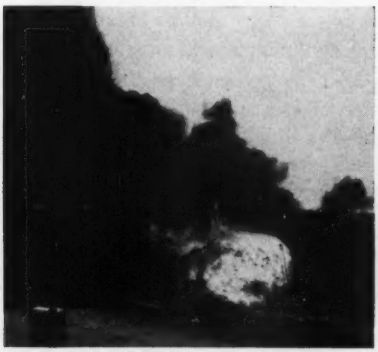


Figure 5

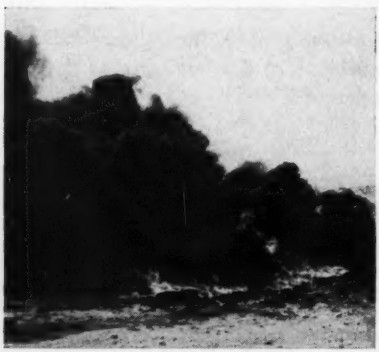


Figure 6

Figures 1-6 show progressive stages of boilover in Test No. 5 where air agitation had been used with air rate set at 0.10 cubic feet per minute per square foot of oil surface. The boilover occurred in one hour and 30 minutes after start of test and lasted for 1½ minutes. No extinguishment was attempted during the test.

Air Agitation Tests in Arabia*

By A. G. Downing and William Fassuliotis
Fire Protection Engineers, Arabian American Oil Company

In order to evaluate the effect of air agitation upon tank fires in the crude oil produced and stored by the Arabian American Oil Company, the Safety Division of the Industrial Relations Department, in cooperation with the Engineering Division, conducted a series of tests involving the use of the air agitation principle upon burning low flash point Arabian crude oil.

Summary

Five field tests were conducted during February and March, 1953, at Dhahran, Saudi Arabia, in a 5-foot diameter steel tank containing 695 to 750 gallons of locally produced crude oil. The tests were established with a tank water bottom in order to simulate conditions normally encountered in the field storage of crude oil.

Both stabilized and unstabilized oil were investigated. The unstabilized crude oil was tested with no air agitation and at a rate of air agitation of 0.02 cubic feet per minute (cfm) per square foot; the stabilized crude oil was tested at rates of air agitation of 0.02 and 0.10 cfm per square foot.

The objectives of these tests were to determine:

1. The rate of burning.
2. The rate of heat wave propagation.
3. The boilover properties.
4. The effect of air agitation upon the above characteristics.

The investigation resolved that the Arabian crude oil tested in the presence of seven tenths of one per cent of water by volume had definite boilover characteristics. Agitation by air at rates of 0.02 and 0.10 cfm per square foot temporarily decreased the rate of burning. However, the crude oil continued to burn and the temperature of the tank contents increased rapidly until boilover occurred in about one half the time required for this action to take place in unagitated crude oil.

Theory

BOILOVER.

It is established that crude oils, after having burned for a period of time, will dispel rapidly a quantity of oil from the burning tank. This phenomenon has occurred in both actual, uncontrolled tank fires and test fires and is designated a "boilover."

Crude oil is a mixture of hydrocarbons of different molecular weights, boiling points, gravities, and vapor pressures. During the course of a fire, the oil in the tank is distilled with the high vapor pressure stock burning off first. Regardless of the effect of increased temperature upon the oil density, the actual density has been increased by loss of the lighter ends by burning. Consequently, the heavy ends

*Based on a confidential report issued by the Arabian American Oil Company entitled "Fire Tests of Arabian Crude Oil, April 1953," and published herein by special permission. The authors acknowledge with appreciation the assistance rendered by Mr. O. W. Johnson, Standard Oil Company of California, Fire Marshal B. E. Robertson and the Dhahran Fire Department.

Figure 7. Surface turbulence in tank produced by air agitation at rate of 0.02 cubic feet per minute per square foot of oil surface.

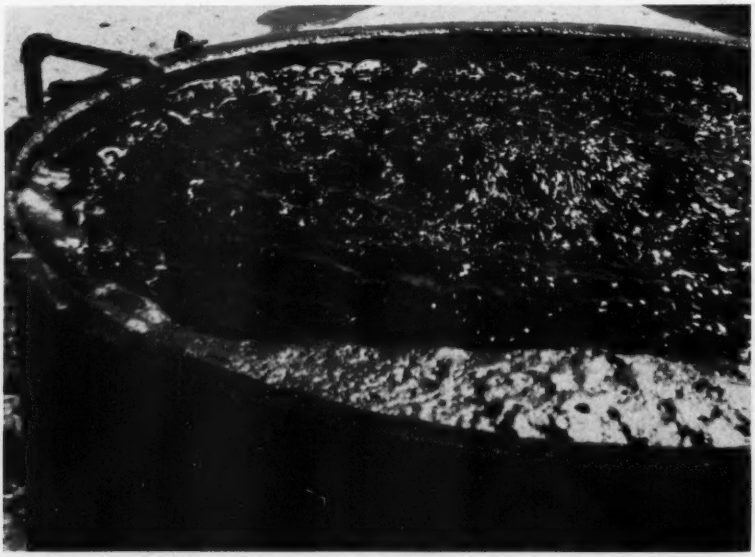


Figure 8. Surface turbulence in tank produced by air agitation at rate of 0.10 cubic feet per minute per square foot of oil surface.

sink through the oil body. This causes fresh, lighter oil to rise to the surface. As the process is continuous, a so-called "heat wave" or "wave front" of hot oil, with estimated temperatures between 300°F to 400°F, is established. This heat wave is steadily projected downward and it is entirely possible that any water of emulsion or suspension in the crude oil is separated in advance of the heat-wave and collects at the tank bottom.

When the wave front of hot oil reaches the sludge and water in the tank bottom, the water is converted to steam with an expansion ratio of about 1,700 times the liquid volume. The heat required for the vaporization of water to steam is obtained from the heat wave which is cooled with an increase in gravity as the heat transfer takes place.

The steam so formed is at a pressure greater than atmospheric by an amount equivalent to the hydrostatic head of oil above the water. The steam rises, assisted by the gradual decrease in oil head. If the oil is of the type that will produce a froth as the steam passes through it, it is likely that a boilover will occur.

Three conditions must exist for a burning tank of crude oil to boil over.

1. The oil must be of a type that will produce a heat wave.
2. Water must be present in some form.
3. The oil must be viscous enough to form a froth as steam is passed through it.

A typical boilover occurring during these tests is illustrated in Figures 1-6.

There is limited transfer of heat between the water and the heat wave. As the water is vaporized, the bottom portion of the heat wave is rapidly cooled. If there is an excess of water over that which will be vaporized before boilover takes place, recurrent boilover may occur as a new heat wave is established and propagated downward. This may occur until all water has been vaporized or the oil has been distilled until it will no longer propagate a heat wave.

AIR AGITATION.

The principle of extinguishing fires by air agitation is founded upon the fact that flammable liquids require a temperature greater than their flash point temperature to sustain burning. If a tank of oil with a flash point above its mass temperature has the surface temperature raised above the flash point, and becomes ignited, the oil fire may be controlled or extinguished by agitation of the oil mass. By this method, cool oil below the flash point, circulated at the proper rate, decreases the temperature of the oil burning at the surface by displacement and mixing below the flash point, and combustion can no longer be sustained. (See Figures 7 and 8.)

The effect of this method of fire control upon low flash point Arabian crude oil, which agitation is unable to cool below its flash point, is a phase of this investigation.

Materials and Equipment Used

In all tests, Arabian crude oil produced from the Dammam Dome structure was used and both stabilized and unstabilized products were tested. The physical and chemical properties of this material are shown in Table No. 1.

The steel tank in which all tests were conducted was 5 feet 5½ inches inside diameter, 4 feet 6 inches deep, with ¼ inch shell thickness.

The depth of oil in the tank was measured by balancing the hydrostatic head of the oil against gas pressure, which pres-

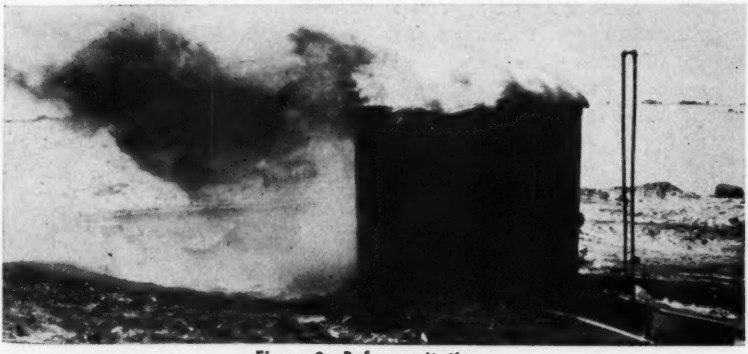


Figure 9. Before agitation.

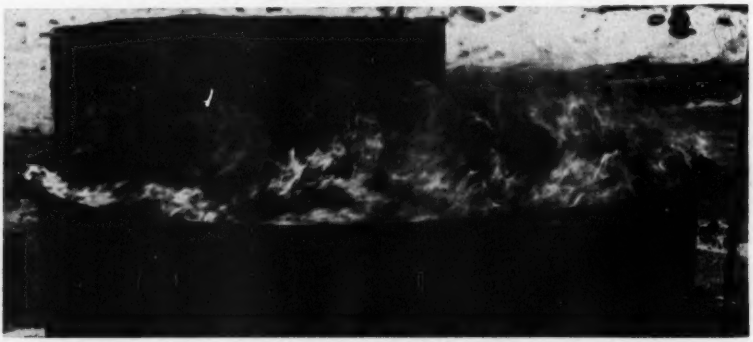


Figure 10. One minute after start of air agitation.

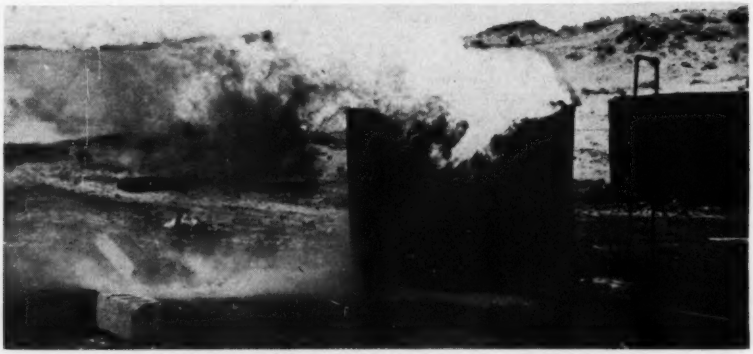


Figure 11. Thirty-five minutes after start of air agitation.

Figures 9-11 show the effect of air agitation upon the burning rate of crude oil in the Arabian tests. The rate of air used in these tests was 0.10 cubic feet per minute per square foot of oil surface.

sure, in turn, was measured by an open water manometer. Gas used to balance the pressure head of oil was passed into the tank at a rate of about one bubble per second.

This equipment does not measure the depth of the burning oil in the tank, which changes with the oil temperature. However, it does record the change in pressure head of the oil, which is proportional to the weight of oil burned, and is thus more significant than change in oil surface level.

The rate of air flow into the tank during the air agitation tests was metered through a circular orifice. The air flow was calculated by means of a formula* for the adiabatic flow of perfect gases where the back pressure does not exceed the critical pressure.

Temperature measurements of the heat wave propagation and oil body temperature were made by the use of Tempilstik** crayon rated at 200°F and 350°F, and by touch assuming that the human hand cannot be held in contact with metal above 130°F without discomfort.

*The formula used was that published on page 114 of "Compressed Air Data, 1939" issued by the Compressed Air Magazine Company, New York, New York and is as follows:

$$W = 0.5303F \frac{aCP_1}{\sqrt{T_1}}$$

W = discharge in cubic feet per minute
a = area of orifice in square inches
C = coefficient of flow = 0.65
P_1 = upstream total pressure in pounds per square inch absolute
T_1 = upstream temperature in degrees F absolute
F = factor to convert pounds per second to cfm = $\frac{60}{0.075}$
0.075 = density in pounds per cubic foot for dry air at 14.7 pounds per square inch and 70°F

**Manufactured by Tempil Corp., New York, N. Y.

Table No. 1

Physical and Chemical Properties of Arabian Oils Tested

Samples Taken After Addition of Water and Mixing by Air Agitation

Test Number	1*	2†	3	4	5
Specific Gravity Absolute 70° F	—	—	0.847	0.852	0.852
Reid Vapor Pressure Lbs. per sq. in.	—	—	3.7	2.0	2.3
Water by Distillation Per Cent	—	—	0.25	0.15	—
Sediment & Water Per Cent	—	—	—	—	Trace
Distillation Per Cent — 390° EP Naphtha	—	—	28.7	27.3	28.3

*In Test No. 1 no air agitation was used.
†No data submitted on Test No. 2.

Method of Test

The test program was divided into two main parts; first, an investigation of the effect of burning upon crude oil, and, second, the effect of different rates of air agitation upon the basic data obtained by the first test. Also, the properties of both stabilized and unstabilized crude oil with free water bottom were investigated. In all, five tests were run.

Between 695 and 750 gallons of oil was used in each test. To this oil, five gallons of free water was added in order to simulate the condition likely to be encountered in the field which is a tank bottom sludge containing between 5 to 15 per cent of water by weight.

Observations were taken at regular intervals except when it was desired to report some important variation in conditions. The burning rate was measured by reading the change in manometer level and correcting for density differences. The 200°F and 350°F temperature levels were measured by the melting of the Tempilstik markings upon the tank shell. All

Table No. 2

Summary of Test Data

Data Investigated	Test Number 1	2	3	4	5
Date of Test	2/7/53	2/14/53	2/15/53	2/16/53	3/10/53
Tank Diameter and Height—Inches	65½x54	65½x54	65½x54	65½x54	65½x54
Surface Area—Sq. Ft.	23.4	23.4	23.4	23.4	23.4
Oil Type—Stabilized or Unstabilized	Unsta.	Unsta.	Unsta.	Sta.	Sta.
Oil Innage—Inches	47½	51	50½	51½	51½
Quantity Oil—Gallons	695	745	735	750	750
Free Water Added—Gallons	5	5	5	5	5
Water by Volume—Per Cent	0.72	0.67	0.68	0.67	0.67
Specific Gravity—Absolute @ 70° F.	0.85	0.85	0.85	0.85	0.85
Reid Vapor Pressure—Lbs./Sq. In.	—	—	3.7	2.0	2.3
Orifice Size—Inches	0	1/32	1/32	1/32	0.0635
Air Rate—Cfm	0	0.47	0.47	0.47	2.34
Air Rate Per Oil Surface Area Cfm/Sq. Ft.	0	0.02	0.02	0.02	0.10
Duration of Preburn Minutes	0	0	10	20	20
Average Burning Rate—Inches/Hour	3.7	3.1	2.7	3.6	3.9
Average Burning Rate During First 10 Minutes After Agitation Started Inches/Hour	—	2.8	2.4	3.6	1.2
Boilover Rate—Inches/Hour	15	36	36	30	34
Total Time to Boil Over Hours and Minutes	3:12	1:25	1:24	1:44	1:30
Duration of Boilover—Minutes	—	2	2	2	1½
Oil Expelled During Boilover Per Cent	90	90	75	90	85
Wind Conditions Direction and Velocity	Variable Light	N 16 mph	NNW 13 mph	N 14 mph	NNW 20 mph

measurements were referred to the original liquid level as datum.

The agitation rate was adjusted visually to a degree believed ample to thoroughly circulate the oil in the tank. (See Figures 7 and 8.) The air flow required to accomplish this agitation was wasted to atmosphere, through a bleed valve, until such time as it was directed into the tank. This enabled the preburn tests to be made and the degree of agitation to be known without further adjustments in air flow into the tank. The rate of air flow into the tank was controlled by the orifice size and upstream pressure.

During the air agitation tests, estimates of the oil temperature were made by touch until such time as the 200°F Tempilstik reacted to the heat. Many other observations relative to flame intensity, smoke and burning noise were recorded.

The average rate of heat wave propagation and boilover rate was calculated by dividing the original depth of oil by the time required to boil over. This average rate is significant although there may be many changes in the slope of a curve, plotted depth of heat wave vs. time.

Discussion of Tests

A summary of the test results is given in Table No. 2.

Test No. 1

The test was run on unstabilized crude oil containing appreciable amounts of hydrogen sulphide gas. It was found that a heat wave of 200°F was promptly established and progressed toward the tank bottom. The 350°F heat wave lagged behind but appeared to slowly overtake the 200°F heat wave. At 12½ inches from the tank bottom the 200°F wave remained stationary for 10 minutes, then rapidly dropped toward the bottom of the tank. It is theorized that the sharp change in rate of propagation may have been caused by water being precipitated out of the oil. For the next 45 minutes the tank cooked with a definite thumping sound. As this sound changed to a simmering or frying noise, the flame intensity increased and the tank boiled over, discharging 90 per cent of the original contents.

Test No. 2

In this test of unstabilized crude oil, no preburn was provided. Air agitation was adjusted prior to firing the vessel, at a rate of 0.02 cfm per sq. ft. of oil surface, which caused rapid bubbling above the air inlet and obvious turbulence throughout the oil body. The air was admitted one foot from the tank shell and about one half inch above the tank bottom. It is interesting to note that the entire tank of oil heated up rapidly and that after one hour the oil mass was approaching 200°F. Shortly after the 200°F mark reached the tank bottom, boilover occurred. The time required was one hour and twenty-five minutes, or 44 per cent of the time required for boilover to occur in the test without air agitation. The boilover lasted two minutes and 90 per cent of the original oil volume was discharged.

Test No. 3

This test is a duplication of Test No. 2 except a preburn of ten minutes was allowed prior to agitation. A 200°F heat wave was formed which was destroyed by agitation indicating effective mixing. It appeared that a slight temperature gradient from top to bottom of the tank was established. The entire body of oil heated up to 200°F rapidly and boilover occurred in 44 per cent of the time required for the unagitated oil to boil over.

TEST NO. 4

This test with stabilized crude oil provided a twenty minute preburn period before air agitation at a rate of 0.02 cfm per sq. ft. was started. A definite heat wave was established prior to agitation. Shortly after the air was added to the tank the heat wave was destroyed, which indicated that the agitation was effective in stirring and mixing the contents of the tank. Again a weak temperature gradient was established from tank top to bottom. The tank boiled over for two minutes after burning for one hour and forty-four minutes.

TEST NO. 5

In this test of stabilized crude oil, the rate of air agitation was increased five times to 0.1 cfm per sq. ft. of oil surface and air was admitted at the horizontal center of the tank; otherwise the test was a duplication of No. 4. The initial rate of burning was higher than the previous tests involving both stabilized and unstabilized crude oil. This discontinuity may have been caused by a relatively strong wind velocity of 20 miles per hour. Upon the addition of air to the oil, the established heat wave was rapidly destroyed, the burning rate was reduced, flame intensity decreased and the tank burned quietly. However, the entire contents of the tank continued to increase in temperature with a slight gradient from top to bottom. After thirty-five minutes, the burning rate began to accelerate rapidly and approached the original rate of burning. Boilover occurred in one hour and thirty minutes, actually in less time than was required for boilover under agitation at the lesser rate. (Figures 9, 10 and 11 show the effect of air agitation upon the burning rate during this test.)

Results

The following results were determined:

1. A definite characteristic to boilover existed (Figures 1-6).
2. Between 75 to 90 per cent of the oil in the tank was expelled during boilovers.
3. Air agitation temporarily decreased the rate of burning (Figure 10).
4. The rate of burning rapidly returned to normal regardless of the degree of agitation (Figure 11).
5. Air agitation decreased by 45 to 55 per cent the time required to boil over.

EDITOR'S NOTE: Readers are urged to review the article entitled "Extinguishing Oil Tank Fires by Agitation," by J. L. Risinger, which appeared in the July 1952 *Quarterly*, for further information on this subject. It should be particularly noted that in none of the tests described herein was any attempt made to secure extinguishment during the period that the air agitation reduced the rate of combustion. These tests do indicate significantly that in crude oil tank fires there is a time element during which fire extinguishing operations must be actively pursued if air agitation is to be of value.

Industrial Storage Fire Potentials*

By R. M. L. Russell

Assistant Chief Engineer, Factory Insurance Association

The recent trends towards erecting industrial warehouses with excessive fire areas, towards piling of goods in storage to excessive heights, and towards location of buildings in areas not served by municipal fire departments, present complicated and increasing problems in keeping the fire potential in such properties within reasonable limits.

The need for low-cost buildings for industrial warehousing has resulted in types of construction where various kinds of preformed wall and roof construction units are placed over unprotected structural steel framing. These structures are certainly more vulnerable than those that use reinforced concrete or fully "fireproofed" structural steel. The trend has greatly increased the loss potential because there is less time available in which to effect fire control before serious structural damage or collapse takes place. There have been fires in which reinforced concrete type warehouses have withstood severe interior fire exposure for better than a half-day without collapse, as against structures of unprotected steel which have collapsed within an hour.

The construction of industrial storage buildings lacking adequate venting facilities either in windows or roof vents is not new. It would seem, however, that the

*Based on an address by the author at the 58th NFPA Annual Meeting held in Washington, D. C., May 17-21, 1954.

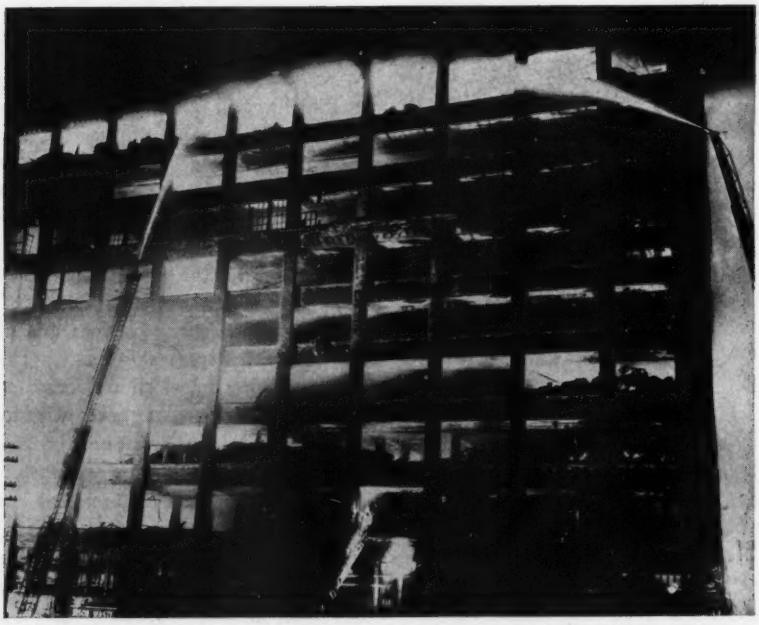
Courtesy NBFU

Heavy "fire-loads" as in this unsprinklered warehouse are an invitation to disaster. See photo next page for after-the-fire view of same property.

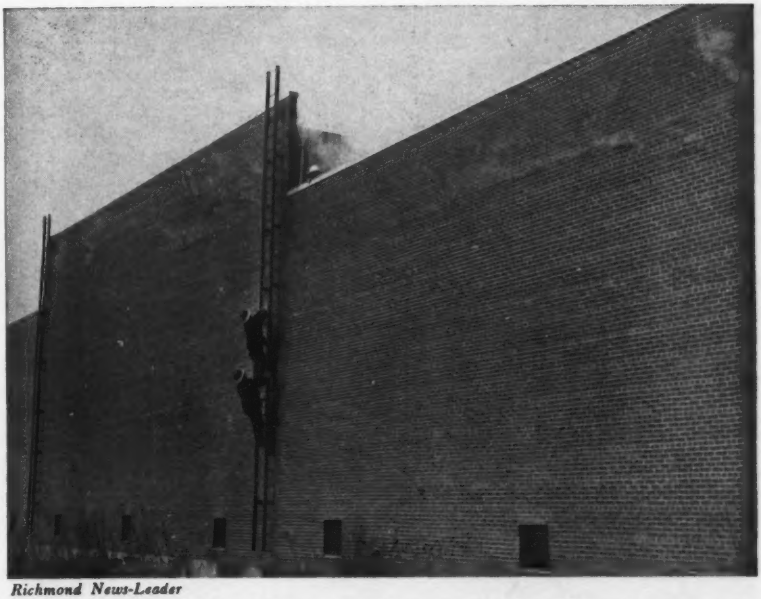
Heavy smoke conditions often bar close approach for manual fire fighting as in this unsprinklered furniture warehouse in San Francisco in 1953. The fire started in a shop when solvent in an open container ignited on an electric heater.

Picture by Pitcher

The *unsprinklered exposed steel* warehouse shown before-the-fire in the photo on the preceding page looked like this after the loss.



In this *fire resistive* warehouse fire the heat was intense but there was no building collapse. For another view see photo, page 72.



Richmond News-Leader

A blank wall and lack of ventilating facilities handicapped firemen in controlling a severe fire in this furniture warehouse at Richmond, Va., in 1951. Sprinklers were ineffective due to poor stock storage arrangement.

need for providing ample smoke escapement facilities has been amply proved by past warehouse fire experience and that provisions for venting would, therefore, be one of the principal considerations in modern warehouse design. Unfortunately, venting is still being ignored. Proper venting and the use of fire-resistive materials in construction are both important factors in fire protection. These factors largely determine the time available for fire control by manual methods.

Fully appreciative that the economics of warehousing dictates the need for utilizing the maximum volume contained in a structure within the sphere of practicability, the present trend of high piling creates a fire control problem that, in some stocks at least, is almost insurmountable.

Rubber tires, foam rubber products, baled rags and paper, cork, cotton and other vegetable fibers in bales are typical of stocks which cannot be stored in high piles covering large areas, without jeopardizing the fire safety of other storage in the area as well as the structure itself. As fire envelops a huge mass of such storage and rapidly migrates into the pile, spreading horizontally and vertically from the point of fire origin, there is an immense release of heat which cannot be adequately absorbed by the normally designed automatic sprinkler system (assuming naturally that no one with fire safety in mind would undertake to warehouse such stock in the absence of sprinkler protection). The reason for this must be obvious. Fire cannot be quenched if water cannot reach it; therefore, as combustion progresses unabated, involving a greater vol-

AP Wirephoto

The author speaks of a serious fire on March 8, 1954 at a western New York warehouse (see opposite page). This is the fire which consumed 300,000 pounds of foam rubber and other materials stored in a sprinklered fire resistive building. Sprinkler protection was overpowered because a floor valve was shut off during the fire when it was believed under control. (For another view, see page 70.)

ume of a massed pile, the cumulative effect is to open more and more sprinklers. This decreases operating pressure, discharge density and sprinkler effectiveness, without arresting progress of the fire within the pile.

As unprotected steel at the roof approaches 1000°F., structural failure is initiated. Specifically, a *fire may not be brought under control* within the time interval in which the steel structure is expected to stand.

Hose streams cannot be utilized effectively for the same reason, namely, piles may be too large or too high, or both, to obtain any material depth of water penetration. Water may find channels of entry into the piles, but the quantity will likely be "too little—too late."

Foam Rubber An Example

A typical example would be helpful at this time. In a burning test of foam rubber in September 1949, it was found that in a 1,500-pound pile about 10 feet high, covering 36 square feet, approximately 750 pounds were consumed in 40 minutes; roughly an average of about one-half pound consumed per square foot per minute. This is equivalent to an average heat release of over 8,500 British Thermal Units per square foot per minute. This product is cellular in nature and is conducive to rapid propagation of fire through the material; once out of reach of water, fire progresses unimpeded. If it were possible for every drop of water to actually reach the burning material, absorb the heat energy and adequately quench the fire, at least 1 gallon of water per square foot per minute would be required. It is obvious that a sprinkler system must be specially engineered, with heads closely spaced, piping oversized and with water of ample volume at high pressure, in order to control even a fire of modest proportions in this material.

Still expanding on this particular storage, I have recently seen foam rubber stored in brown paper bags 10 to 12 feet high, in what one might describe as "tumble" piles, instead of being stored as previously, in heavy corrugated cartons in orderly fashion.

The product is compressed in these bags to about one-third its normal volume. The bags cannot be piled in orderly fashion; they tumble, creep, and roll. Once involved in a fire, the bags will burst and this spongy material will burn in a tumbling, moving, melting mass.

This is not all theory. On March 8, 1954 at a western New York warehouse, it is reported that fire originated from welding sparks in foam rubber cushions and ultimately involved more than 300,000 pounds of the product, stored in individual piles only 400 to 600 square feet in area, 5 feet to 7 feet high. While the initial fire was apparently under sprinkler control, the floor valve was shut off during overhauling operations. In this interval, the fire rekindled with almost explosive violence. It spread rapidly throughout the floor, opening all 140 sprinklers in the area, thus overpowering water supplies which rendered sprinkler protection ineffective. Ultimately this resulted in a general alarm response in less than two hours after the fire started. The loss is reported to be well in excess of $500,000.

Other High Pile Hazards

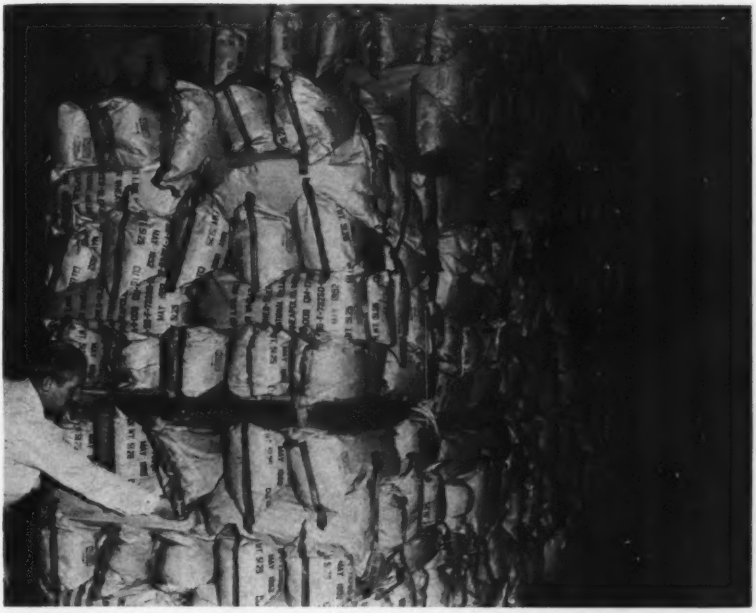
High piling of appliances such as refrigerators, washers, ranges and any number of other products, all create somewhat similar problems of fire control. Some of these piles will exceed 20 feet high and

Concentrated storage of 31,500 crated and cartoned gas ranges, oil stoves and heaters were destroyed in a warehouse fire on New Year's Day, 1951. Loss: $2,000,000.

as many as 10,000 appliance units to a single pile. The value in a single pile, especially with appliances, may easily exceed $1,000,000. This is a situation which fire protection engineers are endeavoring to correct through appropriate recommendations involving limits in the height of, and floor area covered by, a single pile, and the maintaining of main trucking aisles and cross aisles for better access for fire fighting and salvaging operations.

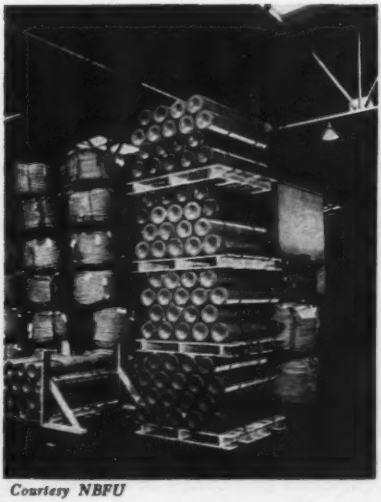
Quite aside from the increased fire potential resulting from high piling, is that of pile stability against the accident peril, not only during normal warehousing operations but especially during a fire emergency. As containers burn or absorb water, the toppling of high piles can readily imperil the safety of both public and private fire fighters working under adverse conditions of limited visibility and very limited aisle space. Where crates or pallets are used for convenience in mechanical stacking of heavy stock or equipment, the burning of such supporting facilities threatens the safety of personnel operating in the building at the time. The prospect of a refrigerator, a stove, or a 500-pound bale of cotton falling from a height of 16 feet to 18 feet is not especially inviting to the fire fighter.

Hazardous as the storage of cotton is admitted to be, at least it can be said that the standard cotton warehouse, broken up into areas of 5,000 square feet each by standard masonry parapeted fire walls, with about 72 sprinklers per warehouse area, was instrumental in the past in keep-



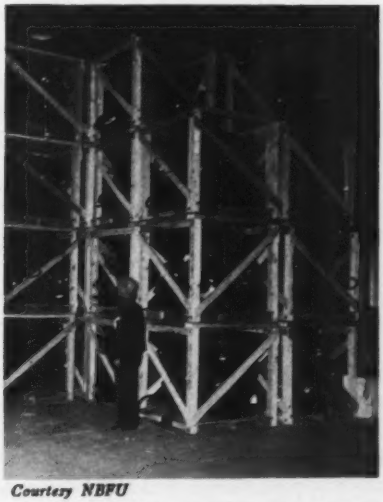
Courtesy NBFU

Pile stability is often difficult to obtain with bagged material.



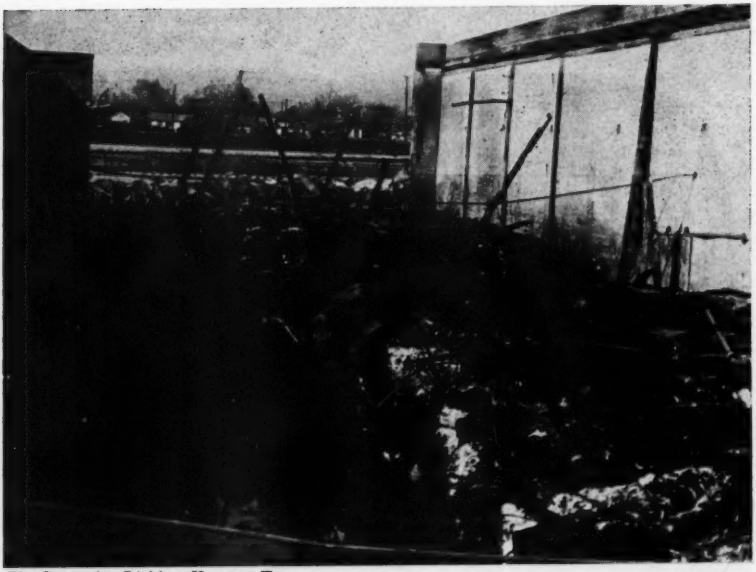
Courtesy NBFU

Under fire conditions, cylinder storage as shown here could become hazardous. Steel wrapping bands might easily snap.



Courtesy NBFU

Palletized crates permit stable storage of unwieldy items but tend to encourage high piling.



Fire Prevention Division, Houston, Tex.

Fire wall subdivisions are common in cotton warehouses. Here the fire walls aided in stopping the spread of fire to a row of similar cotton warehouses along the Houston Ship Channel. Despite a turned-off sprinkler system, open ends on the warehouses and a delay in fire fighting, the loss was restricted to the warehouse of origin and the two adjoining warehouses to which fire spread via platform stock.

ing cotton warehouse losses within reason, usually with confinement of the fire to the area of origin. Constructionwise, it would seem that the standard fire wall, for warehouse subdivision, is rapidly vanishing. Single fire areas approaching 100,000 square feet are not uncommon in industrial warehouses, with values running in excess of $10,000,000 subject to any one fire.

In pursuing such high-valued area trends, an industry invites not only the possible loss of several months production but the likelihood of losing good customers of long standing, whose patronage has made possible the very success of a manufacturing enterprise.*

Industrial Tractor Hazards

The fire peril has not been lessened by the introduction of powered stackers, especially combustion-engine-driven, by use of which high piling has been made possible. While these units have been progressively improved and the inherent hazard decreased, it is not long before poor maintenance or neglect is revealed by fires involving the careless operation of such equipment. The possibility of spilled fuel becoming ignited, as during an upset or collision, introduces a severe hazard which was nonexistent before this type of equipment was used — when areas, individual piles and the values exposed were all smaller.

*See "Indirect Fire Losses in Business" which appeared in the October 1953 NFPA Quarterly and has been reprinted in NFPA Pamphlet Q 47-4 available from the Association for 50 cents each.

This gasoline powered lift truck was being used to transport a load of rolled paper from the storage building of an industrial plant to the manufacturing area. The paper toppled over and struck a pile of drums of calcium hypochlorite. One drum lodged against the truck causing a short circuit between an exposed battery terminal and the frame of the truck. A flash fire developed, spreading to baled waste paper.

Another peril is created by the use of powered stackers and high piling — that of possible water damage when the overhead sprinkler system is accidentally struck in the placing or the removal of stock at the top of the pile. While this should not occur if the operator is careful in judging available clearances overhead, and if the top of the pile provides adequate clearance from the sprinkler system, carelessness in this direction is frequently observed. I have seen high piled stock forced against the 5-inch and 6-inch sprinkler cross mains such that the ring hangers which provide support for these large mains are free to slide along the piping. This type of carelessness frequently results in sufficient injury to the system to cause considerable water damage. In fact, in a four-year survey of losses in our Association, 9.93 per cent of all sprinkler losses, amounting to 6.95 per cent of the total amount paid in all sprinkler leakages, resulted from carelessness in the operation of mechanical stackers.

Smoking

While uncontrolled smoking may not fall under the terminology of storage practices, it most certainly is a practice that requires eternal vigilance if fires from this cause are to be eliminated or even decreased. I have visited hundreds of warehouses wherein smoking is prohibited and any evidence thereof is nonexistent. Then again, I have encountered the argument that outside truckers and employee ware-

Courtesy Pillsbury Mills

Proper clearance of stock from sprinkler piping is illustrated in this finished goods warehouse. Note palletized stock and wide aisles. The dark pipes are sprinkler lines.

Courtesy Hammermill Paper Company

Stock is orderly and housekeeping excellent in this warehouse. Bottom pallets have effect of skidding stock in case of sprinkler leakage.

housemen be permitted to smoke so that they may not have to "sneak a smoke" behind a pile of stock. Smoking can be properly controlled if there is a will to do so.

Fundamental Recommendations

It is not possible to formulate a set of rules which can be applied to all types of storage in all types of warehouse structures. Obviously the fuel potential and physical form of stock, the method of packaging, pile stability, actual value involved, and the available discharge density from the existing sprinkler system, are all factors to be considered in establishing the size and height of piles. However, the following basic rules of good practice may be helpful in setting up stock piling methods in industrial warehouses:

1. Consult both your insurance carrier and your public fire department as to what constitutes the limiting floor area per pile and the limiting height thereof for which effective fire control can be expected both from overhead sprinklers and hose streams, careful consideration being given to the degree of combustibility and pile stability. The painting of lines along the floor, establishing pile limitations, will be found especially helpful in enforcing proper piling practices.

2. The top of stock should clear sprinklers by at least 3 feet, this clearance required for adequate development of the sprinkler discharge pattern and ultimate sprinkler efficiency.

3. Main trucking aisles should be wide enough for safe and efficient operation of two-way traffic; a minimum of 12 feet is considered practical. Cross aisles should be at least 8 feet wide. In highly combustible stock or where pile stability is critical, this cross-aisle width should be increased in order to assure complete access under fire conditions.

4. Not less than 3 feet of clearance should be maintained between piles and sidewalls, due consideration being given to the possible expansion of stock as it becomes water-soaked to avoid lateral pressure against the structure. This same consideration should be given to the piling of such stock around supporting columns, to avoid side-thrust as stock absorbs water.

5. If either stock or container is likely to be weakened with water absorption, thereby threatening pile stability, appropriate racks or pallets should be designed and utilized to prevent or minimize toppling of piles under fire fighting or sprinkler discharge conditions. The skidding of stock at least 4 inches off the floor greatly reduces the possible water damage to stock outside the limits of actual sprinkler discharge, and actual area of hose stream application.

6. Powered industrial tractors and stackers should be listed by Underwriters' Laboratories or other recognized testing laboratory. Extreme care should be exercised both in operation and in maintenance, the servicing and refueling to be done in a safe area outside the storage warehouse.*

7. In addition to an adequately designed automatic sprinkler system, and an adequate distribution of appropriate types of fire extinguishers, inside hose connec-

*See NFPA "Standards for the Maintenance and Safe Operation of Industrial Trucks" (NFPA No. 505B,C. (25 cents) and NFPA Poster 505C-1 (single copies free, $1.00 per dozen). See also October 1953 NFPA Quarterly for article on "Developing Safer Industrial Trucks" by O. S. Carliss, Director of Engineering, The Yale and Towne Manufacturing Company.

tions and hose should be provided such that at least two inside hose streams can be played upon any point on any pile.

8. In order to maintain workable conditions conducive to effective fire fighting, smoke escapement or venting facilities should be provided through roof venting unless window area in outside walls, especially within 5 feet to 6 feet of the ceiling, can be utilized for smoke venting. Suitable breathing equipment should be quickly available, especially if the burning stock can be expected to produce toxic gases.

9. All possible steps should be taken to guard against well-known sources of

WHAT EVERY EMPLOYEE SHOULD KNOW!
SAFE OPERATION of INDUSTRIAL TRUCKS
Based on Recommendations of
NATIONAL FIRE PROTECTION ASSOCIATION
SAFE REFUELING RULES
1. Return truck to location designated for refueling.
2. Stop engines before refueling.
3. Prevent spillage of fuel. Clean-up any spills before restarting engine.
4. Maintain contact between side of fill opening of tank and hose nozzle during fueling.
AVOID DAMAGING FIRE EQUIPMENT
1. Avoid striking sprinkler heads, pipes, fire doors, extinguishers, etc.
2. Keep fire aisles and access space to fire equipment and exit doors clear.
KNOW HOW TO USE BRIDGE PLATES
1. Secure bridge plates and operate carefully and slowly.
2. Sides of bridge plates should be turned up at right angles or other means provided to prevent run-off.
OPERATE AND STOP TRUCK SAFELY
1. Do not attempt repairs or adjustments unless authorized.
2. When leaving a truck unattended:
a. Neutralize controls
b. Shut-off power
c. Set brakes
d. Remove key or disconnect battery
e. Leave forks of fork trucks flat on floor
3. Garage trucks only in locations specified.
4. Do not exceed speed limits: slow down at aisles or when vision is obstructed by doors, corners or elevators, and on slippery or wet floors.
5. Keep truck under your control at all times so a quick stop can be made in an emergency.
6. Always look in the direction of travel.
7. Avoid parking on incline whenever possible; when unavoidable place chocks under drive wheels as well as setting brakes.
8. When driving fork trucks, keep forks as low as conditions permit.
9. Do not tow railroad freight cars with industrial trucks.
10. Avoid stunt driving and horse-play!
WATCH YOUR LOADS
1. Report leaky containers and broken packages to the foreman or supervisor.
2. Know the load capacity of your truck and do not exceed it. Do not counterweight a fork truck to increase its lifting capacity. Use care when tilting a load forward or backward.
3. Where high tiering is necessary, provide special overhead protection for the lift truck and yourself.
4. Do not use elevators unless specifically authorized. Know relation of weight of truck plus its load to capacity of elevator. Shut-off power, set brakes and neutralize controls of truck while on elevator.
LOADING ON RAILROAD CARS
Assure that positive protection has been provided to prevent railroad cars from being moved while bridge plates are in position and men working across them.
It's Your Job — Your Responsibility
GOOD JOB
BAD FIRE
NO JOB!
Printed in U.S.A. 300-6-53-CP
Copyright, 1953, National Fire Protection Association, Boston 10, Mass. (NFPA 200C-1)
Additional Copies $1.00 doz.

This is a reproduction of a 9 x 12 inch poster (red and black) available from the National Fire Protection Association at $1.00 a dozen. (Single copies free.)

Courtesy Glidden Co.

Mechanical handling equipment requires wide aisles to handle stock safely and expeditiously. This feature is well illustrated in this sprinklered paint warehouse.

ignition, especially from uncontrolled smoking, careless, uncontrolled cutting and welding practices, and the piling of combustibles too close to heating and lighting equipment.

The subject of storage practices represents but a fraction of the various considerations which enter into the design, operation and maintenance of fire-safe warehousing that go beyond the scope of this presentation. It is hoped that the foregoing may provide an ample word of caution to those charged with the safe operation of storage warehouses and that future warehousing methods may be directed toward a substantial reduction in the fire loss potential. This can only be possible through a reduction in the size of single warehouse fire areas, reduction in the size and height of individual piles, and the provision of adequate aisles in both directions, along which powered lift truck operators, who are properly trained in their job, can move stock into and out of the area with greater care.

Last, but by no means least, basic fire safety requires the provision of fully automatic sprinkler protection with supervised alarm and watchman service.

Editor's Note: Some of the recommendations given in this paper relative to stock clearance from sprinklers, aisle widths and wall clearance from stock liable to expand due to water soaking are in excess of the *minimum* recommendations contained in the NFPA Standards on General Storage (NFPA No. 231).

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CHARLES BRUNING COMPANY INC.
protects its property *Automatically*....
gets better **FIRE** and **BURGLARY**
PROTECTION and

We are thoroughly satisfied that the complete ADT Automatic Protection Service in our two Chicago plants gives us better protection for our property, our business, and the jobs of our employees, than we could get by other means. At the same time, this type of protection enables us to make a cash saving of $12,000 a year.

Oliver Bruning
Assistant Secretary
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Charles Bruning Company, Inc., manufacturers and distributors of architectural supplies and equipment, chose a combination of ADT Central Station Sprinkler Supervisory and Waterflow Alarm, Burglar Alarm, and Industrial Process Supervisory Services to watch over its Chicago plants...automatically... around the clock.

Mr. Bruning's statement typifies the comments of many executives, from coast to coast, who know that ADT Automatic Services give more security than can be obtained by any other method...at less expense.

An ADT specialist will show you how combinations of engineered services can protect *your* property.

Call our Commercial Department if we are listed in your phone book; or write to our Executive Offices.

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Controlled Companies of
AMERICAN DISTRICT TELEGRAPH COMPANY
A NATIONWIDE ORGANIZATION
Executive Offices
155 SIXTH AVENUE - NEW YORK 13 - N. Y.

We engineer, design and manufacture:

Interior Fire Alarm Signaling Systems.

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Standpipe Fire Line Control and Signaling Systems.

Central Office Systems for Manual Fire, Automatic Heat Actuated Fire Alarm Systems, Sprinkler Alarm and Supervision, Watch Patrol Recording and Kindred Systems.

Supervisory Systems for Detecting Excessive Heat, Pressure and Low Voltage in Transformer Sub-stations and to Automatically Disconnect the Sub-stations from the Line and Load Sides of the Systems.

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Sprinkler Waterflow Detectors.

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Emergency Switches to Shut Down Fuel Oil Systems, Ammonia Compressors and Air Conditioning Systems.

Ground Detector Systems for Hospital Operating Rooms.

ACME FIRE ALARM CO., Inc.

106 SEVENTH AVE., NEW YORK CITY, N. Y.

BLOCK THE SPREAD OF FLAMES AT ALL OPENINGS

CUT OFF DRAFTS

DEFY FLAMES

Made ONLY by KINNEAR

Akbar ROLLING FIRE DOORS

Kinnear all-steel Akbar Fire Doors are the positive, automatic means of blocking off flame-spreading drafts.

Coiled out of the way over the door lintel, Akbar Fire Doors go into action immediately when fire threatens. A strong spring insures positive action. Controlled speed provides added safety of building occupants. Akbar Doors may be opened instantly in any emergency. They automatically close again at once. A special locking device stops the downward action of Akbar Doors at sill level . . . even if the floor is completely burned out. Akbar Rolling Fire Doors can save as much as one third their cost per year in reduced insurance rates.

Akbar Fire Doors may be equipped for daily use with manual or motor operation.

LARGE SIZES:** Kinnear makes doors for firewall openings ranging up to many hundred square feet in area. These doors are built with the same features offered in the labeled doors described above.* ***WRITE FOR DETAILS!

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FACTORIES:

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Save Lives in Doorways

KINNEAR ROLLING DOORS

Ahead Again!

CENTRAL SPRAY SPRINKLERS

Central Upright Spray Sprinkler Type "SSU"

BETTER FIRE PROTECTION

Combining all the superior features of the Central conventional type of automatic sprinklers (which 34 years of unequalled service have demonstrated) with the Central specially designed spray type of distributors, we present the complete line of Central Spray Sprinklers.

Central Spray Sprinklers are more effective and more efficient than any other type of sprinkler.

CHEAPER COST OF INSTALLATION

Their greater area of distribution and their lesser consumption of water combine to produce earlier extinguishment of fires with less water used, smaller pipe sizes and, in most cases, a lesser number of sprinklers required for the same areas.

Therefore, you save money in first installation cost and your fire damage is lessened if a fire occurs.

In every way, you profit by using the latest developed and the most efficient Central Spray Sprinklers.

Manufactured and Installed by

CENTRAL AUTOMATIC SPRINKLER COMPANY

Fourth Street and Cannon Avenue, Lansdale, Pa.

Cable Address — "Sprinklers" — Philadelphia

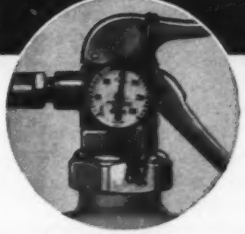
Licensees in principal cities in U. S. of America and Canada and throughout the world.

THEY'RE PRESSURIZED - READY TO GO!

New ALFCO DRY CHEMICAL FIRE EXTINGUISHERS

PDC-5 PDC-10 PDC-20 PDC-30

Unmatched in Fire Smothering Efficiency!



A glance at valve gauge indicates whether unit is in operating order.

WHEN FIRE HITS, THESE NEW ALFCO DRY CHEMICAL MODELS ARE READY TO STOP IT

With Valve and Siphon Assembly removed as single unit, ample size opening is provided for charging.

Simply pull pin and squeeze lever. No gadgets to operate, no last minute pressurizing from a gas cartridge or cylinder, no inverting, no bumping, no shut-off nozzle on the hose needed. They're ready to go!

Their fire-smothering efficiency is aided by a scientifically designed Alfco Discharge Nozzle which fans the Dry Chemical outward and downward in wide pattern and with great density. Their 150 (plus 25 minus 0) psi. air (or nitrogen) pressure maintains an excellently uniform duration of the Alfco Dry Chemical discharge pattern.

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Write us for illustrated literature and full details of their special features.

Model numbers designate the capacities by weight of Dry Chemical.
Approved by Underwriters' Laboratories for Class B and C Fires.
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With 2nd Century of Leadership in FIRE PROTECTION

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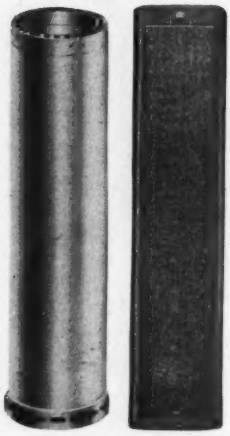
ALFCO

FOR GAS APPLIANCE VENTING

There's no doubt about

METALBESTOS



QC WV

METALBESTOS

for every Type B venting need

Approved by Underwriters' Laboratories. Correctly designed for use with all approved gas appliances requiring Type B vents. (Not for use with oil-burning appliances or gas-fired incinerators.)

QC METALBESTOS
Round Vent—for standard venting applications where space is not restricted.

WV METALBESTOS
Oval Vent—specially designed for in-the-wall venting.

IT'S SAFE

. . . . . because Metalbestos provides an inner "hot stack" for complete removal of *all* vent gases and a cooler, safer outer pipe to protect adjacent surfaces from overheating. Metalbestos was first to introduce the double-wall, insulated vent pipe — now accepted as the standard for proper venting.

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. . . . . because Metalbestos vents are designed to last the lifetime of the house. All-metal construction will not crack or break . . . precision made couplers stay gastight, won't pull apart. Assembled vent is strong and rigid and offers maximum protection against corrosion or accidental damage.

IT'S CORRECT

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TYPE B-W INSTALLATION KIT for safe, approved wall heater venting.

Simplifies venting of recessed wall heaters — fits inside 2 x 4 walls without furring out. Contains all fittings and directions needed to make safe, officially correct installation. Designed for use with WV Metalbestos pipe. Approved by Underwriters' Laboratories, Inc.

METALBESTOS DIVISION
WILLIAM WALLACE COMPANY · BELMONT CALIF

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the perfect squelch

you can't buy better fire protection than **VIKING**

The **NEW** *Viking Spray Sprinkler*

Here's the perfect squelch for fires — The new VIKING Spray Sprinklers offer an improved method of fire control. In tests VIKING Spray Sprinklers have proved much more efficient than conventional heads in controlling fires of various types.

Seven VIKING features give you economy with full protection, with (1) better water distribution, (2) better cooling characteristics, (3) fewer sprinklers operating, (4) more economical use of water, (5) greater ceiling protection, (6) fewer sprinkler heads needed, and (7) VIKING Spray Sprinklers can replace conventional sprinklers without changing piping.

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Offices in Principal Cities

DETECT-A-FIRE®

Rate Compensation Actuated THERMOSTATS insure positive Fire Detection for alarm or release systems

Fenwal DETECT-A-FIRE units are based on an entirely new principle. The outer shell is the sensing element — reacting to the temperature of the air around it. The contacts function when surrounding air reaches a danger level.

- *Hermetic Sealing* of internal electrical components.
- *Stainless Steel Construction* — for corrosion resistance and long life.
- *Temperature Setting Range*, 140 F to 725 F.
- *Long Spacing* . . . 25 feet . . . economy of installation.
- *Repeatable.* Unit re-sets itself, nothing to replace.
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SERIES 70 HORIZONTAL MODEL.

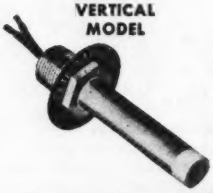
For locations where appearance is a factor. Suitable for all commercial, industrial, mercantile and public buildings, institutions and ships, in locations classified as "ordinary" under the National Electric Code.

TYPES 7020 and 7021

Flush Mounting Unit for new construction and concealed wiring. Type 7020, normally closed circuits; Type 7021, normally open circuits. Designed to fit standard 4" junction boxes. For exposed wiring, Types 7020-1 and 7021-1 with surface adapter ring.

LISTING and APPROVALS: Ⓤ, ⟨FM⟩, USCG, and American Bureau of Shipping Acceptance.

SERIES 71 VERTICAL MODEL



For ordinary and hazardous locations i.e., Class I, Groups C and D; Class II, Groups E, F, and G. Explosion-proof in itself. For hazardous locations, mount to Crouse Hinds CPS 021 Cover or Appleton BFGS Hub Cover for explosion-proof system.

TYPES 7120 and 7121

For concealed and exposed wiring. Type 7120, normally closed circuits. Type 7121, normally open circuits.

LISTING and APPROVALS: Ⓤ, ⟨FM⟩, and American Bureau of Shipping Acceptance.

SEND FOR THESE BULLETINS.

They give the latest authoritative data on fire or overheat detection. They discuss in full the rate compensation principle; give exact engineering data. Write for Bulletins MC-107A and MC-108 to Fenwal Incorporated, 147 Pleasant Street, Ashland, Mass.

Fenwal

DETECT-A-FIRE® Thermostats

DYNAMIC, RATE COMPENSATION ACTUATED FIRE DETECTORS

Use ROLAGRIP couplings for fast, low cost sprinkler installation

This is a 6″ ROLAGRIP coupling for plain end pipe on a sprinkler bulk line in a midwestern aircraft plant. ROLAGRIP couplings and plain end steel pipe were used here because the contractor had to install a permanent, low cost sprinkler system *in a hurry.*

Because the sprinkler system was coupled with ROLAGRIPS, pipe came straight from the mill in economical mill run lots . . . ready to install. It required no special machining, handling or shipping preparation.

Installation time and labor were cut because ROLAGRIPS go on in three easy steps: (1) grease the special synthetic rubber gasket (to prevent pinching) and center it over the pipe ends; (2) lay ROLAGRIP halves over gasket; and (3) insert and tighten two bolts.

Chances are, ROLAGRIPS will save you time and money, too. They come in 1½″ to 12″ sizes; are approved by Factory Mutual and Underwriters' Laboratories.

Write for free folder!

See ROLAGRIPS at your supply store this week. (For grooved pipe, ask for GRUVAGRIPS and GRUVAGRIP FITTINGS — sizes ¾″ to 14″.) Or write today for prices and free illustrated folder No. NCF.

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Today we are all aware of the disastrous and far-reaching effects of a major industrial fire. Owners . . . management . . . employees . . . customers . . . almost every one suffers, in one way or another, when a serious fire strikes.

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One way to be absolutely sure of the efficiency of your plant's fire protection facilities is to call in an expert C-O-TWO Fire Protection Engineer. He is ready and willing to help you with any or all industrial fire hazard problems.

There is a personal sense of responsibility inherent with C-O-TWO Fire Protection Engineers that assures you of fully adequate firesafety . . . a definite plus in your behalf. Whether it's fire detecting or fire extinguishing . . . portables or built-in systems . . . C-O-TWO means top quality backed by experienced engineering that results in operating superiority for you at all times.

WHEN BUSINESS STOPS . . . INCOME STOPS! Don't take chances with your investment. Secure the benefits of highly efficient fire protection engineering today . . . our extensive experience over the years is at your disposal without obligation. Get the facts now!

C-O-TWO

MANUFACTURERS OF
APPROVED FIRE PROTECTION EQUIPMENT
Squeez-Grip Carbon Dioxide Type Fire Extinguishers
Dry Chemical Type Fire Extinguishers
Built-In High Pressure and Low Pressure Carbon Dioxide Type Fire Extinguishing Systems
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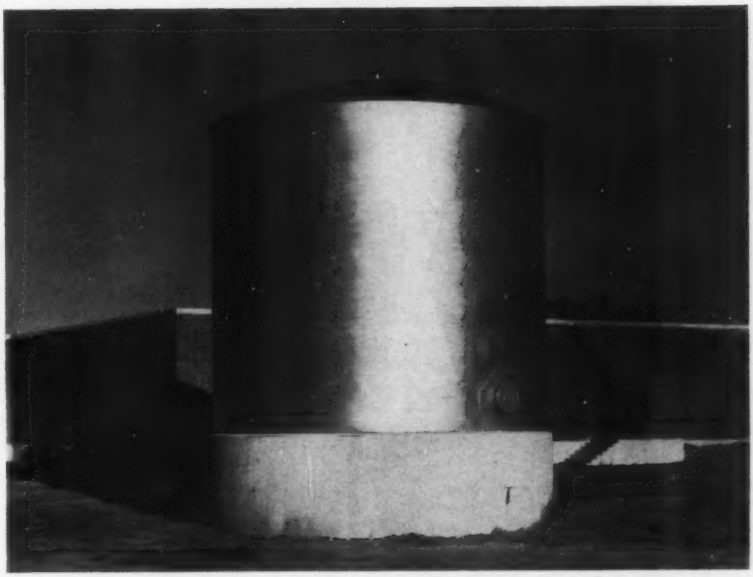
Sales and Service in the Principal Cities of United States and Canada
AFFILIATED WITH PYRENE MANUFACTURING COMPANY

HORTON SUCTION TANK

Installed at Belton Hosiery Mill



As an assured secondary source of water supply for their sprinkler system, the Belton Hosiery Mills of Belton, S. C., installed this 100,000-gal. suction tank. The water in the tank is pumped into an automatic sprinkler system by a 750 gpm unit driven by a 60 hp electric motor. The Belton plant contains 55,000-sq. ft. of floor area, fully protected by 550 sprinkler heads. City water mains are the primary source for the sprinkler system.

Ellipsoidal bottom elevated tanks and Waterspheres are also available to provide reliable water storage for sprinkler systems. Elevated storage utilizes dependable gravity pressure to insure a water supply for fire flow. A plant protected by a sprinkler system with a tank providing the water supply is often charged lower insurance premiums, thus allowing a savings which will pay for the equipment in a relatively short time.

Write our nearest office for quotations or information on Horton tanks.

CHICAGO BRIDGE & IRON COMPANY

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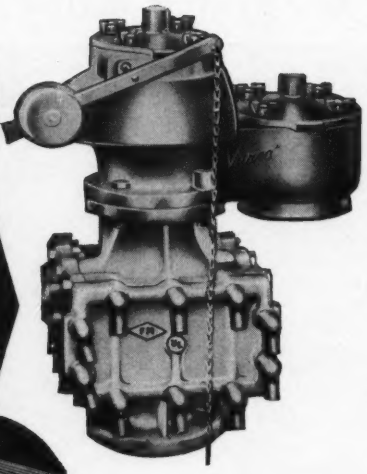
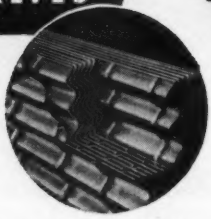
Plants at Chicago, Birmingham, Salt Lake City and Greenville, Pa.

WHEN STORING FLAMMABLE LIQUIDS IT PAYS TO BE

EXTRA **Safe**

with "Varec" FLAME ARRESTERS In combination with your VENT VALVES





"VAREC" Fig. No. 5800 Vent Unit consisting of "VAREC" Conservation Vent Valve in combination with "VAREC" Flame Arrester.

The belief that conservation vents or breather valves alone will prevent travel of flame back into flammable liquid storage tanks is questionable because of the many contributing factors. Careful authoritative analysis reveals that valves by themselves do provide *some protection* but this "protection" *is by no means adequate* under all circumstances.

Safety authorities emphatically advise that "vent valves are not regarded as providing the required protection against fire and explosion." A textbook on safety states that "a conservative policy is to provide flame arresters in conjunction with other vent equipment on all cone-roof atmospheric tanks handling oils with a flash point up to 200°F open cup."

"VAREC" Flame Arresters when used as a unit with "VAREC" Vent Valves give you full fire protection at extremely low cost. Average installations run approximately .1 of 1% of your investment in tank and products. Consult your nearest "VAREC" representative or write for further information.

THE VAPOR RECOVERY SYSTEMS COMPANY

COMPTON, CALIFORNIA, U. S. A.

Cable Address: VAREC COMPTON USA (All Codes)

NF-1

PROVED and APPROVED "Varec"

SAFER

liquid handling for Industry

THIS NEW TOKHEIM HAND PUMP contributes to safer handling of volatile liquids wherever used. Stops wasteful dripping and slippery floors. Reduces fire hazard and accidents common to other methods of liquid transfer. Approved for handling petroleum liquids—ideal for many others. Available in hose and spout models—for drums, skid tanks and underground installations. Order from your dealer, your oil company or your Tokheim representative. **Write factory for literature.**

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Designers and Builders of Superior Equipment Since 1901
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Call the Ansul Man

for faster, more effective fire

FAST, EFFECTIVE EQUIPMENT. A positive activating system puts Ansul's "Plus-Fifty" dry chemical to work immediately—no lag or delay. To insure full fire coverage, patented nozzles deliver the right kind of stream for your fire protection problem (low velocity or long range).

DEPENDABLE EQUIPMENT. Ansul extinguishers are water-tight, corrosion resistant, always ready for action, even after extreme weathering and exposure to wide temperature variations. Quality features like these make it possible for Ansul to back their equipment with a 5-year warranty.

TRAINING FOR YOUR PERSONNEL. At Marinette, Wisconsin, Ansul operates one of the largest and best equipped fire-training schools in America—to train your key protection men without cost or obligation. A trained Ansul man will also instruct your fire brigade at your plant.

COMPLETE PLANT SURVEY. Knowing and recognizing a fire protection problem takes a highly trained man. The Ansul man is a specialist in utilizing fire extinguishing equipment properly and effectively—he will see to it that your plant gets the best protection possible at the lowest cost.

Get in touch with your local Ansul man through the "yellow pages" or write

ANSUL CHEMICAL COMPANY, Fire Equipment Div., Dept. F-21, Marinette, Wisconsin.

FOR *Essential*
PLANT PROTECTION

PITTSBURGH • DES MOINES

ELEVATED STEEL TANKS

An ever-ready supply of water at dependable pressure contributes greatly to plant security. When a modern Pittsburgh-Des Moines Elevated Steel Tank stands guard over your plant, fire protection problems are lessened, lower insurance rates are gained, better water service is a continual benefit. *Write for our latest 20-Page Elevated Tank Brochure.*

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DES MOINES (8). . . . . 969 Tuttle Street
DALLAS (1). . . . 1273 Praetorian Building
SEATTLE . . . . . 576 Lane Street
SANTA CLARA, CAL. . . 675 Alviso Road

FIRE!

PUT IT OUT IN SECONDS

with a Kidde Portable extinguisher

Unless someone gets the jump on fire the minute it starts, a plant owner stands a good chance of kissing his business good-bye.

That's why it's so important to have a Kidde portable extinguisher near *every* fire hazard in every plant.

See to it that motors, electrical equipment, flammable liquids and machinery are protected with Kidde portables. Then, when fire strikes, anyone nearby can grab a Kidde CO_2 or dry chemical portable, aim the horn, pull the trigger, and—Whoosh! No more fire!

For more information on beating fire to the punch . . . Contact Kidde today!

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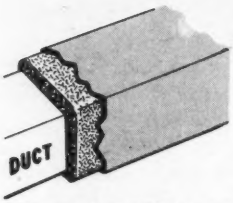
INSULATION
FIRE-BAN
SURFACE COATING
Permanent • Fire Retardant
For surface application; by brushing, spraying or trowelling, in one coat (1/16" to 1/4" thickness). Applied over cork, cellulose boards or unpainted wood; fiber, foam glass and other types of sheet or block insulations.
Listed by Underwriters' Laboratories, Inc.

When applied to insulation, Fire-Ban provides fire-safety construction. Hard, rigid surface protects insulation against mechanical injury. Permanent smooth, washable surface purest white or choice of colors.



When applied to insulation covering ventilating ducts, Fire-Ban not only provides a fire-retardant surface, but a hard, rigid protection against mechanical damage to the insulation. Surface is smooth and cleanable, decreasing accumulation of combustible dusts.

FIRE-BAN is a 100% inert composition that will not burn . . . prevents ready ignition of combustible materials . . . frequently saves fire rate penalty of combustible building materials. Conforms to "slow-burning" requirements of Federal Specifications SS-A-118a.

FIRE-BAN is economical enough for low cost construction. Weighs only 6½ oz. per sq. ft. when applied 1/16" thick. No reinforcement required . . . no surface scoring needed to provide for expansion.

FIRE-BAN provides a monolithic surface that will not curl, blister, check, craze or peel. Not affected by extreme temperature fluctuations, withstands drops to minus 75° F. The surface is none-dusting and non-toxic; does not become tacky when subjected to frequent washings. Thoroughly "field-tested" for over six years.

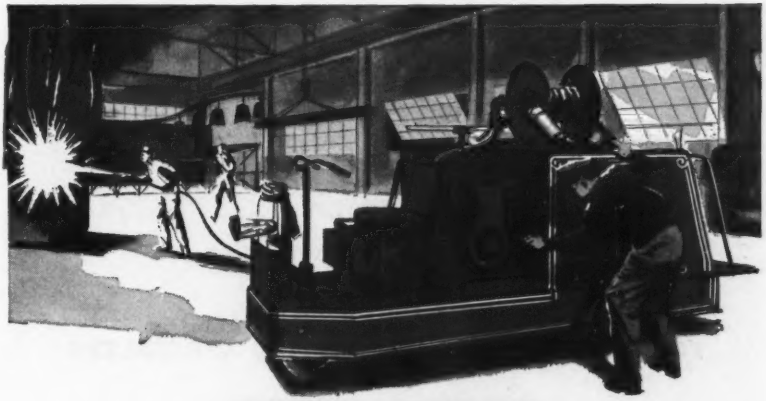
FREE SAMPLES

Samples of Fire-Ban applied to wood, fiber or cork board, foam glass, Styrofoam, Rubatex and fiber glass supplied upon request. Please specify.

Fire Protection Engineers, Inspectors, Architects, etc., can obtain samples of Fire-Ban with instructions for experimental use . . . no charge or obligation. Write for new Bulletin 54 or outline your problem.

E. H. O'NEILL FLOORS COMPANY

2531 South 50th Ave. **Cicero 50, Illinois**



STOP FIRES
before they become Disasters

WITH THE NEW
KALAMAZOO
Fire Fighter

Your own IN-PLANT FIRE DEPARTMENT will snuff out dangerous blazes in seconds.

15 MPH—3-wheel maneuverability—equipped for any type of plant.

Every day, fire disasters cripple firms through lost production and lost markets—the costly result of inadequate or malfunctioning equipment.

That's why the new mobile Kalamazoo Fire Fighter is the perfect addition to any plant or warehouse. It maneuvers through narrow aisles and standard doorways—and turns "on a dime." It comes equipped with a complete fog system, a 210-gallon water tank, 100-ft. hose, or any chemical extinguishers required for your particular plant—whether you produce paint, plastics, etc.

Don't delay—a Fire Fighter will be invaluable insurance against a fire disaster. Write Dept. QF-7.

K KALAMAZOO
MANUFACTURING COMPANY
1827 Reed St. Kalamazoo, Mich., U.S.A.

FOR OVER 71 YEARS SERVING INDUSTRY AND RAILROADS ALL OVER THE WORLD

GLOBE
SAVEALL
SPRINKLER

PRODUCT OF THE CHEMICAL AGE

FOR NEW INSTALLATIONS
FOR REPLACEMENT OF EXISTING SPRINKLERS

UPRIGHT

SOMETHING NEW
•
SOMETHING DIFFERENT
•
FIREMEN EVERY 10 FEET

PENDENT

SAVEALL AUTOMATIC SPRAY SPRINKLERS
APPROVED BY ALL INSURANCE AUTHORITIES

Fifty-five years experience in manufacturing automatic sprinklers enables us to produce the Saveall Automatic Spray Sprinkler, the last word in appearance, sensitivity, durability, efficiency, quality, accuracy of performance.

Illustrated pamphlet available on request.

Manufactured and Installed by
GLOBE AUTOMATIC SPRINKLER COMPANY
Philadelphia, Pa.
Offices in Principal Cities

Designed for tapping a main under pressure. Flange on one side of valve bolts to sleeve; other side of valve may be hub or mechanical joint connection, either of which has special flange cast integral for attaching any standard make tapping machine. Can be furnished with or without bonnet flange for indicator post, or with rising stem for use in manhole or valve pit. Features of M & H sleeve are strong, heavy design and liberal length.

M & H Tapping Valves of this design are Underwriters approved and Tapping Sleeves are Manufacturer's Standard. For complete information, write or wire M & H VALVE AND FITTINGS COMPANY, Anniston, Alabama.

M&H PRODUCTS FOR WATER WORKS • FILTER PLANTS INDUSTRY • SEWAGE DISPOSAL AND FIRE PROTECTION

GRIMES

AUTOMATIC *Spray* SPRINKLERS

ENGINEERED FOR BETTER FIRE PROTECTION

Upright Model S.S.U.

Pendant Model S.S.P.

Grimes Devices are approved by all insurance interests.

LOWER INSTALLATION COST
Fewer Sprinklers Needed Per Area

LOWER CEILING TEMPERATURE
More Uniform Lateral Distribution of Water

MINIMIZES FIRE and WATER DAMAGE
Extinguishes Fires Faster With Less Water

INTERCHANGEABLE WITH CONVENTIONAL SPRINKLER HEADS

Manufactured and Installed by

RAISLER

SPRINKLER DIVISION

RAISLER CORPORATION Executive Offices - 129 Amsterdam Avenue, New York 23, N.Y.

Licensees in all principal cities in the United States and Canada.

Underwriters Laboratories, Inc.

INSPECTED

TYPE EX POWER-OPERATED
INDUSTRIAL TRUCK
FOR HAZARDOUS LOCATION
CLASS 1 GROUP D NO. 101

Designed not only for safety but also economy . . .

Clark's new EXPLOSION-PROOF Carloader

Clark's electric Explosion-Proof Carloader was specifically designed to meet the rigid requirements of Underwriters' Laboratories, Inc. It was the first lift truck to receive Type EX, Class I Group D approval. It is safe for operation in atmospheres containing explosive fumes and vapors, such as gasoline, lacquer, propane.

In addition to *Safety*, the new Explosion-Proof Carloader provides outstanding economy and battery efficiency. It utilizes the same basic control system which enables *all* Clark electrics to outperform other equipment—to work a longer cycle without recharging batteries.

We invite you to compare the new Explosion-Proof Carloader with any comparable truck on the market. Call your local Clark dealer—listed in the Yellow Pages. Or write for details.

CLARK EQUIPMENT

Industrial Truck Division
CLARK EQUIPMENT COMPANY
Battle Creek 190, Mich.

☐ Send details on "EX" Carloader

Name_____

Firm_____

Address_____

City_____ Zone_____ State_____

YOUR ASSURANCE OF *FIRST-TIME* AND *EVERY-TIME* DEPENDABILITY FOR FLAMMABLE LIQUID FIRES

JUST OUT—"Foam Fire Protection," illustrated booklet on what Foam is, what it does, how it works. Yours free.

EVERY BATCH of AER-O-FOAM is tested on actual petroleum or polar-solvents fires before it is offered to you. Each phase of the performance is checked—such as extinguishment time, foam volume and sealability.

AER-O-FOAM's tough blanket of tiny air-filled bubbles smothers and cools fire at the same time. What's more, it can be used to insulate surrounding property and equipment against fire damage. Write for data on AER-O-FOAM (for petroleum fires) and AER-O-FOAM "99" (for polar-solvent or petroleum fires). When you need foam fire protection, you need *fire-tested* AER-O-FOAM protection.

NATIONAL
FOAM SYSTEM INCORPORATED
Headquarters for Foam Fire Protection — WEST CHESTER, PA.

NOTIFIER is copied but NEVER EQUALLED!

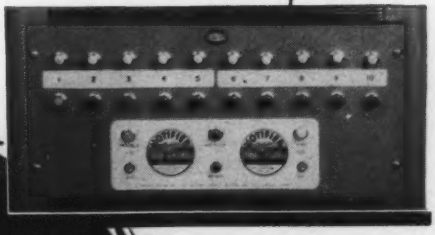
We dare you to compare NOTIFIER with any fire detection equipment on the market. Compare them piece by piece, part by part, and **then compare them for service and dependability** —NO MANUFACTURER OF FIRE DETECTION EQUIPMENT HAS EQUALLED NOTIFIER'S DEVELOPMENTS!

World's Newest Complete U. L. Listed Remote System

Fully automatic fire detection system—complete from protected property into fire station control panel.

Designed to meet any requirement

Notifier is designed to meet state and municipal requirements in multiple dwellings, hotels, hospitals, schools, factories, institutions, nursing homes, etc. DEALERSHIPS AVAILABLE.



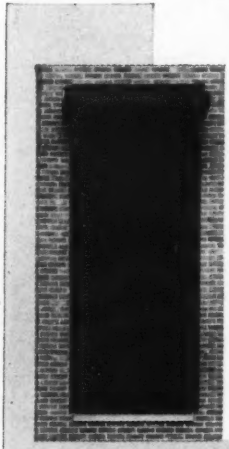
NOTIFIER Automatic FIRE ALARM

Your Inquiries Are Invited — Write To

NOTIFIER MFG. CO.

Dept. Q-3
239 South 11th Street
Lincoln, Nebraska

Automatic Rolling Steel FIRE DOORS *and* WINDOW SHUTTERS PREVENT SPREAD *of* FIRE!



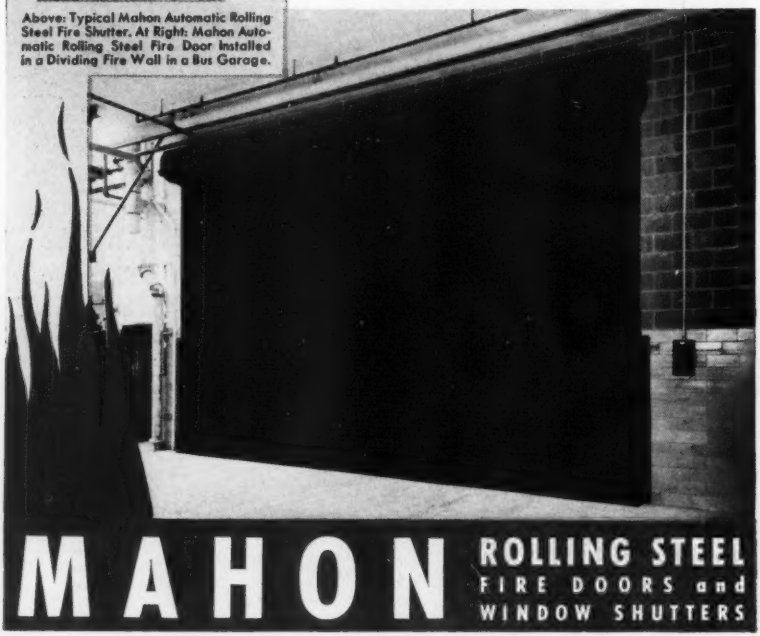
You need good automatic fire doors in fire walls, corridors, and vertical shafts . . . in some cases automatic rolling steel window shutters are necessary to protect your building and its contents from fires which may originate in nearby buildings. Many, many cases are on file which confirm that timely action of automatic rolling steel fire doors and window shutters have confined a fire to its point of origin and permitted its being extinguished with comparatively small damage. Make a survey of your building now, and don't delay action. You will find a Mahon Automatic Rolling Steel Fire Door or Window Shutter to meet each of your requirements—all bear the Underwriters' Label. These automatic fire doors may be operated manually or mechanically in every day use. If a fire should break out while they are in the open position, the automatic mechanism will close the door, cutting off drafts and preventing the spread of the fire. See Sweet's Files for complete information, or write for Catalog 654.

THE R. C. MAHON COMPANY

Detroit 34, Michigan • Chicago 4, Illinois

Manufacturers of Automatic Rolling Steel Fire Doors and Window Shutters. Also Many Types of Standard General Service Rolling Steel Doors and Grilles, Insulated Metal Walls, and Steel Deck for Roofs, Floors and Partitions.

Above: Typical Mahon Automatic Rolling Steel Fire Shutter. At Right: Mahon Automatic Rolling Steel Fire Door Installed in a Dividing Fire Wall in a Bus Garage.



MAHON ROLLING STEEL FIRE DOORS and WINDOW SHUTTERS

this "ounce" of protection...

is worth ten times its capacity in fire hose

A single Blaw-Knox Spray-Head, shooting its quenching spray of water right into the very heart of a starting fire, can accomplish more than several hose streams each having ten times its capacity.

The Blaw-Knox Spray-Head, protecting you around the clock, puts water to work wherever and whenever needed. Its finely divided spray, directed in the most effective pattern, provides much greater fire control with less water.

Multiply this kind of fire fighting efficiency in a system engineered to guard against your specific hazard and you are assured of a maximum of protection.

No cash outlay is required and the system will pay for itself in reduced insurance premiums within a few years. Let a Blaw-Knox Fire Protection Engineer study your needs and submit an estimate . . . absolutely without obligation.

Blaw-Knox fire protection systems carry approvals of all insurance underwriters

Deluge Systems •
Wet Pipe Systems •
Dry Pipe Systems •
Water Spray and Fog Systems • Rate-of-Rise Sprinkler Systems •
Foam and Carbon Dioxide Extinguisher Systems

You'll be interested in the new Blaw-Knox booklet, **"Fire Can Destroy Your Business."** There's no charge. Write for it.

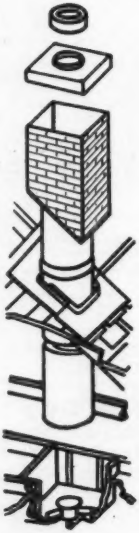
"Little Joey Sprinkler" always on the job

BLAW-KNOX COMPANY

Automatic Sprinkler Department
Pittsburgh 33, Pennsylvania

6 Facts About Van-Packer Chimneys

every fire safety man should know



1. The Van-Packer Safety Chimney is built with a fire clay tile liner (the *only* material proven safe thru the years). 3″ insulating concrete wall is equivalent to a 24″ brick chimney wall.

2. FHA accepted, UL listed, approved by major codes and U.S. Army Engineers for any and all domestic fuels.

3. The Van-Packer fire clay liner will withstand temperatures in excess of 2100° F.

4. Machined section joints permanently sealed with acid-proof, leak-proof joint cement.

5. So safe that wooden rafters can be in direct contact with chimney (Underwriters tested and so listed).

6. Fireproof, weatherproof cement-asbestos housing above roof has appearance of conventional brick.

For further information on the Van-Packer write for Bulletin No. 41G-AF23

Van-Packer

Packaged Masonry Safety Chimney with Brick-Panel Housing

Van-Packer Corp. • 209 S. LaSalle St. • Chicago 4, Ill.

Instantaneous WaterFOG Protection Controls Fire Hazards

The Lake Superior District Power Company's switchyard shown above, must have absolutely dependable fire protection for its giant, oil-filled transformers. Hence, the Rockwood WaterFOG System which instantaneously releases millions of particles of cooling, heat-absorbent water that choke off oxygen and reduce temperature in case of fire.

This same WaterFOG is now available to every type of property through Rockwood WaterFOG Sprinkler Heads that discharge WaterFOG from conventional sprinkler systems. Insurance authorities give these heads a 30% increased fire coverage over ordinary heads. Be sure to specify them for safe — and speedy — fire protection.

Plan now to get your free copy of Rockwood's illustrated booklet "From Navy Fire Fighting to Better Sprinklers." Find out how gas and flames are prevented from mushrooming and needlessly opening adjacent heads. Learn how a cooling wall separates gas and flames from ceiling — how less water is used, fire-and-water damaged reduced, and costly production time saved. Send coupon today.

ROCKWOOD

SPRINKLER COMPANY

Engineers Water . . . to Cut Fire Losses

ROCKWOOD SPRINKLER COMPANY
Fixed Installation Division
247 Harlow Street, Worcester 5, Massachusetts

Please send me your illustrated booklet on WaterFOG Sprinkler Fire Protection.

Name.....

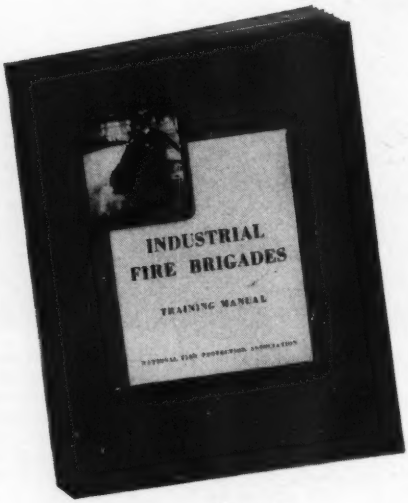
Title.....

Company.....

Street.....City.....Zone.....State.....

New Edition . . .

INDUSTRIAL FIRE BRIGADES
Training Manual



How to Organize and Train a Modern Fire Brigade in Your Plant

Printed on fine, glossy paper, 8½ by 11 inches page size with sewed binding to open flat.

166 pages and 385 illustrations

Single copies $3.25

QUANTITY prices on orders to one address: 25 or more $2.45 each.

Subjects outlined and illustrated include:

- Plant Fire Protection
- Fire Causes and Hazards
- Making Forcible Entry
- Handling Rope
- Using Fire Extinguishers
- Handling Ladders
- Handling Hose
- Producing Effective Fire Streams
- Salvage Practice
- Rescue Work
- Inspection of Equipment
- Fire Fighting

Order from:

NATIONAL FIRE PROTECTION ASSOCIATION

INTERNATIONAL

60 Batterymarch St., Boston 10, Mass.

The AMAZING New

Star Spray Sprinkler!

With its

Unequalled Performance

Gives You . . . . . .

(MODEL C—UPRIGHT)

SUPERIOR PROTECTION — revolutionary in method — for any type of occupancy — no matter how severe the hazard . . . . . with

LESS WATER USED — more effectively and more efficiently — for total extinguishment and cooling. . . . All water discharged goes directly on the fire — not on the ceiling. . . . Ceilings are so cooled that no sprinkler will open unnecessarily. . . . . .

STAR SPRAY SPRINKLERS — the ultimate in modern fire protection — can replace former-type sprinklers without changes in piping. . . . . Available for installation in either **UPRIGHT** or **PENDENT** position.

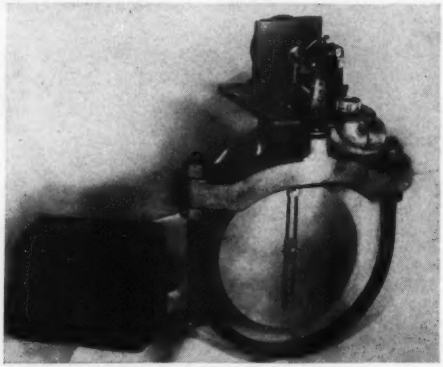
Approved by Factory Mutual Laboratories
Listed by Underwriters' Laboratories, Inc.

Write for name and address of STAR licensed contractor nearest your location, to:

STAR SPRINKLER CORP.

Westmoreland and Collins Sts. — Philadelphia 34, Pa.

Licensees in all Principal Cities of the United States and Canada



5-inch size shown above. To install simply drill 2-inch hole in pipe.

Model PRS-1 Sprinkler Waterflow Alarm

This device is approved by Factory Mutual Laboratories and Underwriters' Laboratories, Inc.

- This device is also made as Model PRT-1, a coded waterflow transmitter.

- Also made in explosion proof models.
- Made in all sizes from 2½" to 8".
- Has instantly recycling pneumatic retarding device, which prevents false alarms.
- Has enclosed electrical contacts for 15 amp. 125 volts, A.C. and ½ AMP, 125 volts, D.C.

Size is 1⅜" x ⅜"

Tempo-Set Model A Fire Detector

Underwriters' Laboratories, Inc. Approved.

- Self restoring and can be heat tested.
- Electrical contacts are silver or gold and are enclosed.
- Very reasonable price.

- Tempo-set Model A is approved in either open or closed circuit and the temperature ratings are 140 and 200 degrees.
- Approved spacing is 20' x 20'.
- Electric ratings are 125 volts 1 ampere, A.C. or 24 volts 0.5 ampere D.C., or less.

CENTRAL STATION SIGNALS, INC.

Manufacturers of all kinds of approved devices used in Central Station Systems or Class 'A' or Class 'B' Proprietary Fire Alarm Systems, either automatic or manual.

53 WEST 23rd STREET **NEW YORK 10, N. Y.**

The Shand & Jurs HYDRAFOLD valves and INTERNAL SAFETY valves go hand in hand like Pat and Mike. But it's no joke how they provide maximum efficiency in the discharge of truck tank contents The S&J HYDRAFOLD valves enable just one meter to serve several tank compartments through a manifold. These valves and corresponding INTERNAL SAFETY valves are selected and operated simultaneously by the S&J Operator. Both the HYDRAFOLD and INTERNAL SAFETY valves are normally held closed by spring pressure and can be opened only by the time proven, dependable hydraulic pressure system. Tiny fusible plugs which melt at 165° F. are located strategically in the hydraulic lines. Should fire endanger the truck tank or contents the plugs will melt releasing hydraulic pressure and allowing both the HYDRAFOLD and INTERNAL SAFETY valves to close instantly. Designated by S&J as Fig. 13050, these HYDRAFOLDS are available in 3" and 4" sizes. Another model, Fig. 13930 is available in the 2" and 3" sizes.

Shand and Jurs Co.
BERKELEY 10, CALIFORNIA
NEW YORK
CHICAGO
HOUSTON
TULSA
LOS ANGELES

RELIABLE SPRAY SPRINKLER

- Greater Coverage!
- Lower Ceiling Temperatures!
- Faster Cooling of Hot Fire Gasses!
- Better Fire Extinguishment with Less Water!
- Fewer Sprinklers Operating Adjacent to Fire Area!

Incorporating the new principle of water distribution, the Model "C" Spray Sprinkler is another example of Reliable's leadership in new product design. All Reliable Sprinkler Devices are the assurance of the ultimate in fire protection . . . and have been protecting life and property for over 80 years! Reliable Sprinkler Devices are distributed . . . installed and serviced by Reliable's chain of licensed representatives located throughout the United States, Canada and foreign countries. A Reliable representative is as near as your phone. . . . Call him for a system designed to your specific needs!

Constant Fire Protection That's Always "Reliable"!

THE RELIABLE AUTOMATIC SPRINKLER CO. INC.

Cut your Costs

—and Storage Problems

With

Nicerol

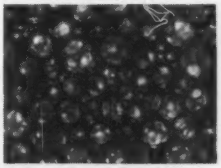
3% Foam Compound

THREE GALLONS of Nicerol and 100 gallons of water will produce over 1,000 gallons of Nicerol foam through a mechanical air pump. Changing and replacing strainers is reduced to a minimum, as Nicerol does not form sludge even after long storage. Its pH of 6·8 to 7·3 indicates neutrality, thus ensuring freedom from corrosion in valuable equipment, and in storage drums. A less obvious factor in Nicerol economy is its speed of effective action. Nicerol saved several hundred million dollars in World War II, and is still supplied under contract to several Navies and Air Forces throughout the World.

***NICEROL*—THE LONGER LASTING AIR FOAM**

Keeps longer in storage–Puts out more fire faster–Outlasts the fire

Magnification X 30



Here's why Nicerol Air Foam gives greater heat resistance

The minute closely-knit bubbles retain the maximum water content in a foam that is both adhesive and cohesive. This is the reason that air foam made from Nicerol resists fire breakdown, puts out more fire faster, and definitely outlasts the fire to prevent flash-backs.

INQUIRIES INVITED FROM DISTRIBUTORS AS WELL AS USERS.
FULL TECHNICAL AND COMMERCIAL DETAILS AVAILABLE FROM

GEORGE T. REYNOLDS & ASSOCIATES, P.O. BOX 395, THORNWOOD, NEW YORK., U.S.A.
BRITISH FIRE EXTINGUISHERS LTD., 222 SIMCOE ST., TORONTO 2B, ONTARIO, CANADA

SAFE MANUFACTURERS NATIONAL ASSOCIATION

(Incorporated)

W. J. Parker
Secretary-Treasurer

366 Madison Ave., New York (17) N. Y.
MURRAY HILL 2-2925

If You Are Contemplating Purchase Of Products For The Protection Of Records From Fire Or Theft

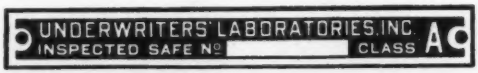
BEWARE OF UNLABELED PRODUCTS!!!

Products of very doubtful fire or burglary protective qualities are appearing on the market. They are described as "insulated" in what many informed persons believe to be a deliberate effort to imply protection which in reality does not exist.

Their exaggerated claims of protective qualities have no foundation in fact. These products carry no recognized label certification and their protective qualities of even minimum standards cannot be substantiated.

These misrepresentations and misleading claims about "insulated" products—with the resulting danger of a sense of false security on the part of users of these products — are matters of grave concern to the members of the Safe Manufacturers National Association. The members of this Association make approximately 95% of the certified, scientifically tested insulated equipment manufactured in the United States.

When you purchase equipment for the protection of records or other valuables, insist that the products you buy carry either the label of the Safe Manufacturers National Association or that of the Underwriters' Laboratories — or both.



The label of Underwriters' Laboratories certifies tested performance by this testing organization whose findings are generally recognized as the impartial and authoritative criterion of fire safety.

Labels of the Safe Manufacturers National Association (SMNA) represent certification by the manufacturer that his product meets the specified standards of performance under fire conditions.

Don't be misled by the unsubstantiated claims of unscrupulous manufacturers. Both impartial labeling services are available to any manufacturer whose products qualify.

LOOK FOR THE LABEL AND BE SURE YOU ARE SAFE!!!

Members, Safe Manufacturers National Association, Inc.

Diebold, Inc., Canton 2, Ohio
Hall's Safe Co. Inc., Hamilton, Ohio
Herring-Hall-Marvin Safe Co., Hamilton, Ohio
Meilink Steel Safe Co., Toledo 6, Ohio
Mosler Safe Co., Hamilton, Ohio
Protectall Safe Corporation, Hamilton, Ohio
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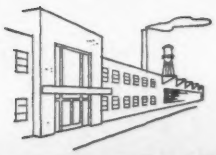


Von Duprin fire and panic exit devices

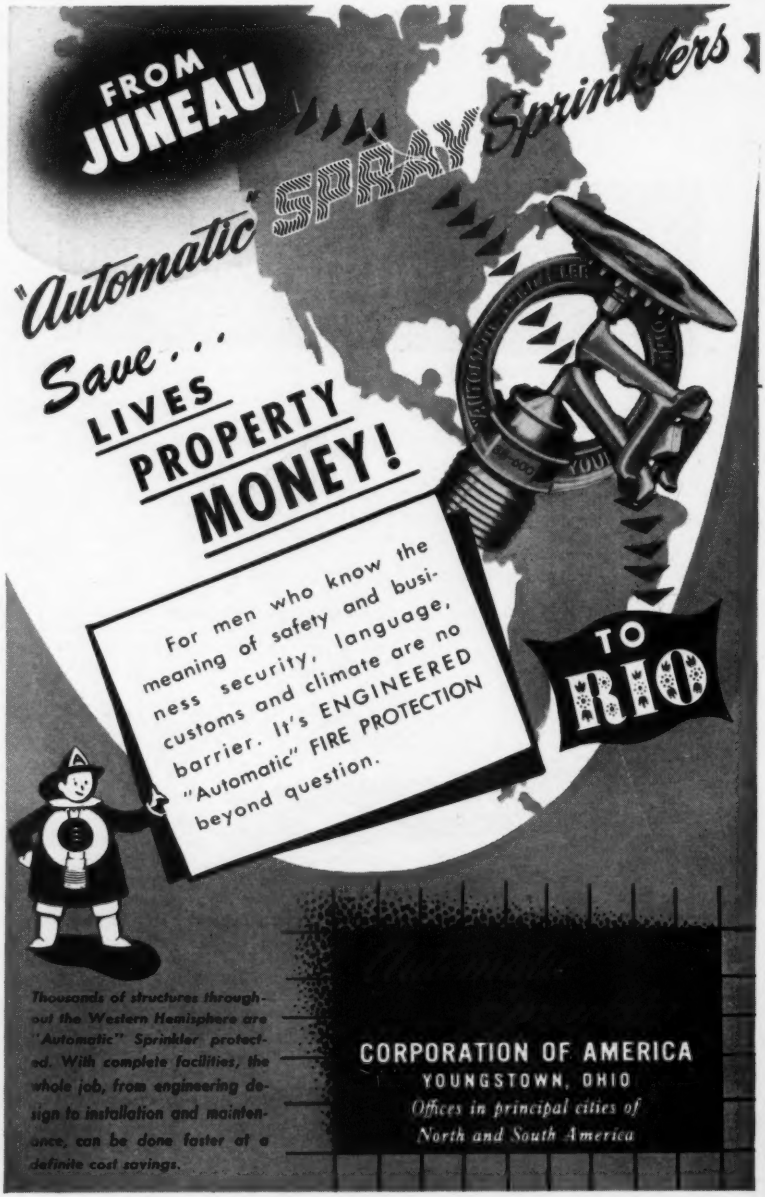
"THE SAFE WAY OUT!"

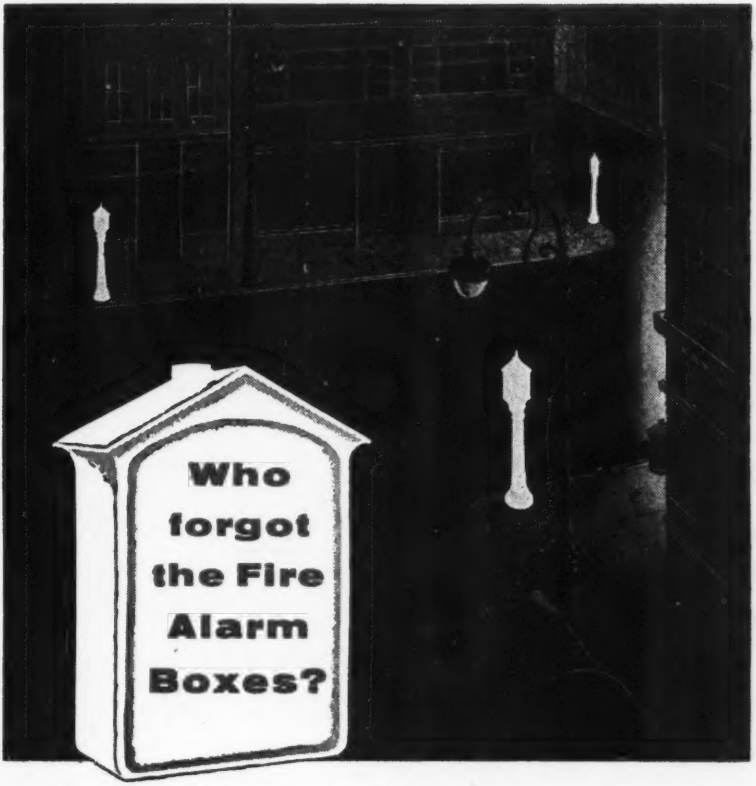
In buildings of all types all over the nation . . . wherever "safe exit" is a factor . . . Von Duprin devices are on duty.

Through proved performance and continuous improvement—ever since Von Duprin marketed the original exit device in 1908—these products have earned the confidence and trust of all safety-minded people.

For expert help in selecting the type of device best suited to your needs, call on your Von Duprin "Exit Specialist." For his name, write Von Duprin, or contact the contract hardware distributor in your own community.

VONNEGUT HARDWARE CO. • VON DUPRIN DIVISION
INDIANAPOLIS 9, INDIANA


FROM JUNEAU
TO RIO
"Automatic" SPRAY Sprinklers
Save...
LIVES
PROPERTY
MONEY!
For men who know the meaning of safety and business security, language, customs and climate are no barrier. It's ENGINEERED "Automatic" FIRE PROTECTION beyond question.
Thousands of structures throughout the Western Hemisphere are "Automatic" Sprinkler protected. With complete facilities, the whole job, from engineering design to installation and maintenance, can be done faster at a definite cost savings.
CORPORATION OF AMERICA
YOUNGSTOWN, OHIO
Offices in principal cities of North and South America



Of course your hydrant coverage is planned along with community growth.

And equally important for community safety is extension of the Fire Alarm Box System that makes it possible to use the hydrants *fast*.

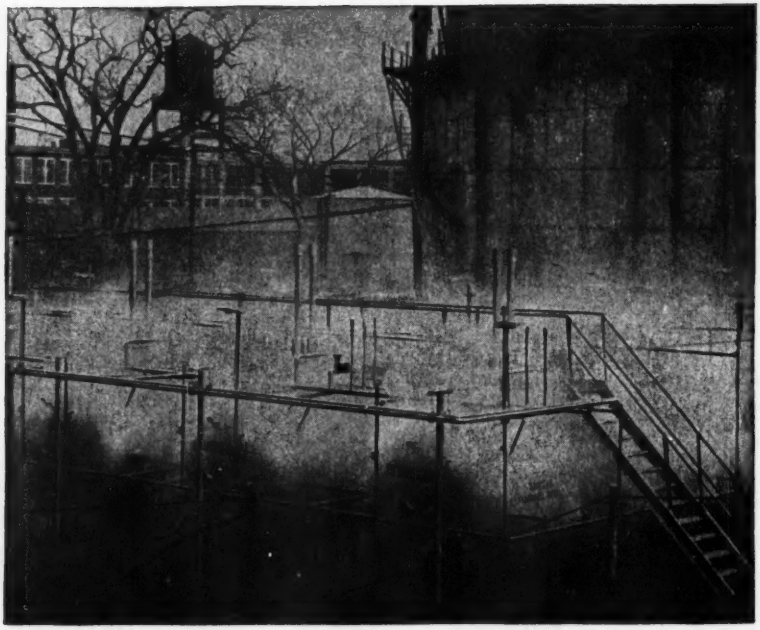
The growing community today needs *complete* fire protection to safeguard its growth in the future.

GAMEWELL®

THE BOX IS POSITIVE

Reduces Human Error

THE GAMEWELL COMPANY • NEWTON UPPER FALLS 64, MASS.



PROTECTOSPRAY SYSTEM FOR LPG STORAGE

Fire and explosion hazards from liquefied petroleum gas occur mainly when there is leakage. At such times, and if disaster is to be averted, several things become immediately necessary, whether or not ignition occurs.

1. The leak must be located and the leakage stopped. ProtectoSpray protection provides a margin of safety for the personnel doing this work.

2. Heat transfer to the storage tanks must be prevented to avoid build-up of rupturing pressure within the tanks. Properly engineered fixed water spray protection provides effective cooling of tanks to prevent pressure build-up.

3. Positive air turbulence should be provided to hasten dilution of escaped gas to make the mixture too lean to burn. Water spray, without dependence upon wind to assist it, provides sustained air movement which hastens the dilution of escaped LPG.

4. Additional inert vapor should be provided to speed the dilution of escaped LPG. Water spray is an abundant source of such inert vapor, the finer droplets in the spray vaporizing to produce inert water vapor.

5. If escaped gases ignite, the wide and evenly distributed pattern of fine water droplets from ProtectoSpray nozzles permit safe, controlled burning of gases.

There is a Grinnell Fire Protection System for every fire hazard. Grinnell Company, Inc., 274 West Exchange Street, Providence, R. I.

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PROTECTION AGAINST EVERY FIRE HAZARD